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The

Electrical Review

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Electricity in Coal Mines.

NO better illustration of the value of research could well be found than the paper which Prof. W. M. Thornton, O.B.E., recently read before the Institution of Electrical Engineers, and of which an abstract is commenced in this issue. Research is sometimes directed towards the development of an idea with a view to its commercial exploitation—for instance, the low-temperature carbonisation of coal; or it may be aimed at the removal of some obstacle to progress, such as the refusal (until 1909) of tungsten to be "drawn"; or again, and this is its most general form, its object may be to penetrate further into the unknown for the pure love of discovery, without ulterior motives—a class of research which is at the foundation of electrical engineering; but there can be no research more noble or praiseworthy than that which seeks the preservation of mankind from death or suffering. It has been Dr. Thornton's privilege to carry on such work for some 14 years, and the results which he and other workers have attained are of the first importance.

Coal mining is one of our greatest and most vital industries, employing about 1,130,000 persons; it is also an arduous calling, and is attended with dangers which, in spite of stringent regulations and elaborate precautions, cannot be wholly eliminated. To lighten the labour of coal-getting and hauling and to render it possible to deal with shallow seams which could not be worked by hand without excessive cost, mechanical power is necessary, and as Prof. Thornton remarks, "electricity is the perfect medium for conveying energy underground," but unfortunately it introduces fresh risks which must be countered by suitable precautions. The most disastrous mine explosion on record in this country, which took place in 1913 and resulted in the loss of 439 lives, is believed to have been due to the sparking of a signal bell, which, as was strikingly demonstrated at the Institution last week, could be rendered com-

pletely innocuous by simply shunting the windings with a non-inductive resistance.

Most interesting are the facts which have been ascertained with regard to the ignition of explosive mixtures containing methane and coal dust. It has been found that alternating current is always safer than direct, and though power circuits cannot be made safe except by complete enclosure, lighting and signalling circuits can be rendered harmless. The fact that a direct current of 0.4 A at 200 V will ignite an explosive mixture, whereas an alternating current of no less than 23.5 A—60 times as much—at 150 cycles per second and the same voltage is required to cause ignition, is a striking discovery. Prof. Thornton would go further and supply the lighting and signalling circuits at 15 volts, 160 cycles, when the most explosive mixture could not be ignited with less than 175 amperes, a value which could easily be rendered unattainable. Moreover, if a low-voltage circuit were used it would be easy to provide the miner at the working face with ten times the illumination that is at present available.

We do not propose to follow Prof. Thornton further through the record of his interesting investigations, but to draw attention to another aspect of the subject which has recently been touched on in our columns. Let it be granted that the use, and the greatly extended use, of electricity in our coal mines is indispensable to the maintenance of output and the improvement of the working conditions. It must be agreed also that there is probably no class of work in which electricity has to operate under greater disadvantages—water, mud, electrolysis, ill-usage, rock-falls, and the presence of inflammable gases and dust. Worst of all, perhaps, is the ignorance of the miner himself—we do not use the term reproachfully, as miners are not expected to be electricians. At the same time, it is clear from Prof. Thornton's and others' remarks that the use of electricity in mining is something of an art in itself, and that competent supervision of its application is absolutely of supreme importance. Nevertheless, it is beyond question that in many mines the electrical apparatus is not maintained in that efficient and well-kept condition which is essential to the safety of the workers. We do not suggest that all colliery electricians are ignorant and incompetent; still less do we suggest that colliery electricians who are members of the Association of Mining Electrical Engineers are unworthy of their charge—rather the contrary, for the mere fact that they have sought and gained admission to that body argues the possession of ambition and ability. But we do affirm that many electricians in charge of electrical plant underground are gravely lacking in qualifications for that highly responsible post, and that such a state of affairs ought to be made *impossible*.

That the Association of Mining Electrical Engineers, as a whole, agrees with that contention cannot be doubted. But what has it done to carry that policy into effect? So far as those of its members who are colliery electricians are concerned, it is doing excellent educational work, and it has set up a high standard of competency, the attainment of which is marked by the issue of certificates, the value of which we do not question, but that is a purely voluntary matter. There is nothing voluntary about the certificate that a sea-going engineer must possess; consequently so far as certification can ensure competency, we may say that all sea-going engineers are competent—they have at least complied with the regulations laid down to that end.

Because we urge that similar compulsory tests should be applied to colliery electricians, and allege that the Association was formed to settle the question of responsibility and raise the status of the engineers, we are taken to task by its leading officials, and in our "Correspondence" pages to-day the president, Mr. W. T. Anderson, states the case "on behalf of the Association." Our reply will be found on another page; here we can only repeat that the duties of a colliery electrician can only be efficiently performed by adequately trained men, and that it ought to be made impossible to entrust them to others.

Small Advertisements: A Word to the Wise —and Others.

It has always been the desire of the ELECTRICAL REVIEW to maintain the usefulness of its advertising pages by preventing the publication therein of undesirable announcements. By "undesirable" we mean untrue, libellous, or intentionally deceptive statements, also small advertisements which appear to be traps to catch the unwary, or offers of educational assistance from those who, from evidence brought to our notice, have not made a practice of acting fairly towards those who have had transactions with them. It is, however, impossible for such a censorship, exercised by any newspaper, to be complete, and we shall always welcome, and treat with confidence, information concerning any unfortunate experiences to which users of our small advertisements may be subjected. By means of such co-operation we shall be able to continue to maintain the high standard of value to all classes in the electrical profession and trade of this important link between employers and employed.

Whatever we may do, however, to safeguard the section against abuse, we cannot be expected to decide for the man who is in search of employment what his line of action shall be when answering an advertisement or negotiating with the advertiser. There are some things anyhow which must be within his own discretion. Much can be said for and against the use of "Box" numbers, but the balance of argument weighs in favour of their continuance. A "Box" number has no reputation, however; it is a lifeless sort of thing, and the applicant, if he be wise, will not entrust to it his *original* testimonials—he will send *copies*. On the other hand, we have no words too hard for the advertiser who fails to return documents which he knows to be of value to those who have responded to his invitation.

There are various other points that might be urged with regard to the Small Advertisement section, but we will mention only one now, and that because of certain recent occurrences. When men are in search of employment they may, either as advertisers or as postal applicants, come into touch with those who attach to their offers of positions terms which require payments in cash for some purpose or other. Not everybody is equally alert for the wrong-doer; some believe everybody sound and trustworthy until they have had a bitter experience. The mere remark that good money has been lost by good men who thought that their little capital was securing them a position in which they would be able to earn an honest living, will serve to indicate the necessity for the job-seeker to keep his wits about him and retain his means until he knows enough to convince him of the *bona fides* of the other party and of the tolerable safety of his investment. The man with large sums to invest can generally afford to take the advice of men of knowledge, but a recent prosecution, followed by sentence of imprisonment, is a warning to advertisers for employment who are asked to contribute trifles in order to enable their would-be benefactor to secure for them a berth.

The Registration of Contractors.

THE long-awaited "National Register of Electrical Installation Contractors," to which the members of that fraternity "look for salvation," as one of them recently expressed it, has now been launched, and elsewhere we give a *résumé* of the rules and conditions of registration. Its motto is appropriately "Experto crede," which sums up the first clause in the Memorandum of Association; briefly, its purpose is to enable the public to distinguish contractors who have given evidence of their competency, to raise the efficiency and status of contractors as a body, and to issue certificates to duly qualified contractors. We are informed that the Executive Committee desires to open the door as wide as a reasonable discrimination makes possible, admitting every contractor, whether working on a small or large scale, who is able to carry out electrical installation work on reasonably safe and sound lines. As all certificates have to be renewed yearly, any

error of admission can be rectified by non-renewal. No new rules or restrictions will be set up, nor will the cost of installation work be increased in any way; inspections of the work of registered contractors will not be made, unless an ostensibly well-founded complaint is made, and then the investigation will be thorough and impartial.

It is interesting to observe that the Register arose out of the I.E.E. Wiring Rules; the revising committee found that there was a wide divergence of opinion on the question of making the Rules compulsory, and sought some other means of attaining a proper standard of wiring practice. Compulsory registration was subject to serious objections, but the necessity of eliminating the small minority of inefficient and financially unsound contractors was manifest. Hence the voluntary registration scheme was put forward, and under the aegis of the Institution of Electrical Engineers an independent body was formed, styled "The National Register of Electrical Installation Contractors," which has obtained the licence of the Board of Trade to become incorporated as an Association not instituted for profit but with limited liability, and with liberty to drop the word "limited" from its title.

We believe that the step that has been taken will prove of the greatest benefit to the industry and to the public, and we hope that the scheme will be favoured with the cordial support of all contractors who fall within its scope.

Prices and Profits.

AT frequent intervals the financial policy of municipal electricity supply undertakings is assailed by interested parties, who, it may be said, often do not realise in which direction their true interests lie. This time it is the Manchester Electricity Department which is attacked. The Manchester Retail Traders' Association asserts, or supports the assertion made by a member of a local firm, that the financial policy of the department (and other municipal trading departments) is "excessively prudent," and "too onerous on the present generation." By this is meant, apparently, that the Department's provision for depreciation, loan repayment, and other sinking or reserve funds is too liberal. The Association considers that more should be done in the way of rate relief, and thereby raises once more the vexed problem of the disposal of profits in which is involved the conception of a public supply undertaking's correct function. It is implied, in an indirect, but none the less obvious manner, that the reduction of electricity charges should not be proceeded with too rapidly. From our point of view, which is that of the industry, there could be no more pernicious suggestion put forward. The whole future of the domestic load (and not this alone) is dependent upon low and still lower charges, and to suggest that prices should be kept up for the benefit of the rates is to adopt a myopic view unworthy of any thinking person or association of persons. The retention of high prices means retarded growth reacting in a damaging manner upon the undertaking itself, those who are supplied, would-be consumers, the manufacturers, and all connected with the industry.

It is encouraging to note the reply of the chairman of the Manchester Electricity Committee to the representations thus made. He announces the intention of his department to adhere to the existing financial system which has been examined thoroughly and found satisfactory, and, what is better, he re-affirms the Department's intention to reduce the prices of electricity as fast as is possible consistent with prudence.

It is our duty to see that the progress of electricity is facilitated in every possible way, and particularly by means of low prices, and our ideal is to provide electricity for all. When this desirable position has been reached, the issue between the two parties will *ipso facto* disappear.

Metal Patterns by Electro-deposition.

VERY great progress has been made in connection with the electro-deposition of metals in recent years; the usefulness of electroplating is not fully realised, and there are still unexploited fields. There is room, for instance, for the development of gun-metal deposition. A recent application of electro-deposition is to the construction of metal patterns. Unless a large number of castings is required, it is still customary—even with small and simple work—to make them of wood, but for repetition work, metal patterns have increased in popularity in recent years. It is much cheaper to cast small electrical parts and motor engine parts from metal patterns fastened to plates and moulded on a machine. Cast iron is the cheapest metal used for the purpose, but in brass foundries the tin-zinc alloys are largely used for temporary patterns, because, after fulfilling their purpose, they can be melted down and used in making alloys of which tin and zinc form a part. Tin-antimony alloy is also used, and aluminium has become very popular.

It is necessary to understand clearly what has already been done in the use of metal for pattern-making to appraise with some accuracy the value of making patterns by deposition, a description of which process appeared recently in a metallurgical contemporary. As the patterns are exact duplicates of the original in size, shape, and finish, it is claimed that machining, scraping, and filing are practically eliminated. So sensitive is the method that it is possible to ascertain whether the original patterns were made of mahogany or pine, because the grain of the wood is clearly shown. Centre lines are also reproduced. It is stated that the method —the procedure is similar to electrotyping—is being adopted by many of the large automobile manufacturers in America, owing to the high degree of accuracy obtained in producing duplicate patterns as well as the comparatively low costs.

That this new pattern-making method has a future is indisputable. Copper, brass or nickel can be used. It is as well, however, to realise that there are limitations to its development. Aluminium has valuable properties, and it is possible to get very accurate aluminium cast patterns, and the castings are exceptionally smooth. The big motor manufacturers may ultimately adopt electrodeposited patterns, but the seeming simplicity of the ordinary methods, although they may be more costly, will always give them an advantage. It should be remembered also that a very large number of firms that make metal patterns have not yet installed plant for the electrodeposition of metals.

German State Works as Companies.

ONE by one certain State establishments in Germany are being transferred to share companies for the purpose of their being managed on commercial lines so as to yield business results, although either all or most of the shares are held by the State. The first great transaction of this kind took place two or three years ago when all the Reich war arsenals were transferred to the Deutsche Werke, A.G. Now the railways, post and telegraph undertakings, and the Prussian State coal and other mines, ironworks, &c., are being conveyed to one or more companies, with special reference to the several collieries belonging to the State in the district of the Ruhr. In Saxony, too, a similar movement is in progress, as the coal mines and electricity works owned by the State have just been handed over to the A. G. Sächsische Werke. In welcoming this operation, the Union of Saxony Manufacturers suggest that under the new auspices the undertaking should not be allowed to develop into a monopolistic position to the detriment of trade, industry, and agriculture in the matter of supply and prices, but should be worked for the common good so as to ensure the supply of electricity at the lowest possible prices and under the most favourable conditions to consumers.

D

Self-Exciting Alternators.

By F. CONTELL.

It has been recognised that one of the great disadvantages of the alternating-current generator lies in the fact that it has to be excited by direct current produced either from a separately-driven d.c. generator or from a small d.c. generator mounted on an extension of the main generator shaft. Many attempts have been made to surmount this difficulty, and suggestions have been put forward for exciting the field from an a.c. supply, although these have not, the writer believes, been used on a practical scale. A patent has recently been applied for in this country (and patents are pending in other countries) for a machine by means of which, it is claimed, it is possible to excite an alternating-current generator with the current from the generator itself, and thus we get what can properly be termed a self-exciting alternator in exactly the same way as the direct-current generator can be said to be self-exciting. The essential part of the invention consists in the special way in which the alternator is excited, and in the use of an auxiliary alternator when the main generator is being started up, this auxiliary alternator being excited with direct current from some external source of supply. After this special unit has been got under way all the incoming machines are started from the bus bars. Thus in a large power station containing a number of generators, except for the special exciting unit which must be of the form shown diagrammatically in the accompanying figure, all the generators will be of simple form without exciters.

The principle upon which this special machine is designed is based upon the fact that in an alternator excited by an alternating current yielding a rotating magnetic field we have the following fundamental formula:—

$$f_2 = np/2 \pm f_1,$$

where—

f_2 = frequency of the generated e.m.f.,
n = revs. per sec. of rotor,
p = number of poles, this being the same in both stator and rotor,
f_1 = frequency of the exciting e.m.f.

If the excitation is in the stator and we obtain the generated current from the rotor terminals, the + sign holds good when the movement of the rotor and the rotating field in the stator are in opposite directions. If both rotate in the same direction then the − sign holds good. If, on the other hand, the generated currents are obtained from the stator terminals, the + sign holds good when the magnetic field in the rotor and the rotor itself are moving in the same direction, and the − sign when they rotate in opposite directions. The conditions under which the machine will be self-exciting will be when $f_2 = f_1$ because both the applied and the generated e.m.f.'s are of the same frequency. This will occur either when $n = 0$, *i.e.*, the rotor is stationary, the machine functioning as a static transformer, or when $f_1 = np/4$, under which circumstance for a given instantaneous value of n, the velocity of the exciting rotating field relatively to the rotor will be one-half of the velocity of the rotor, in the same direction of rotation if the excitation is in the stator, or in opposition if in the rotor itself. The self-excited alternator, once it has been started, will continue to be self-exciting at any speed that the machine is run at. The value of the frequency of the generated current will always be equal to a quarter of the product of the number of poles and the revolutions per second. Thus, a two-pole turbo-alternator could be run at 6,000 revs. per minute, or a 3,000-revs.-per-minute machine could have four poles for a frequency of 50 cycles.

The only difficulty is at the start, and it is for this purpose that the special auxiliary alternator has been devised. Referring to the diagram, the main generator G has an auxiliary alternator A mounted on the same shaft, but the number of poles on A is only one-half of that on G. This auxiliary alternator has its field excited from a secondary battery B through the variable voltage regulator S_4, this circuit being controlled by the double-pole switch S_4, although any other source of direct current could obviously be used. The frequency of the current generated by the auxiliary alternator is always of the value np/4, and this current is fed to the main generator by closing the switch S_3. When the machine has reached its normal running speed, the switch S_1 is closed, and the generator G feeds the busbars, 1, 2, 3. Then when the voltage of the busbars is equal to the voltage at S_2, which can be obtained by

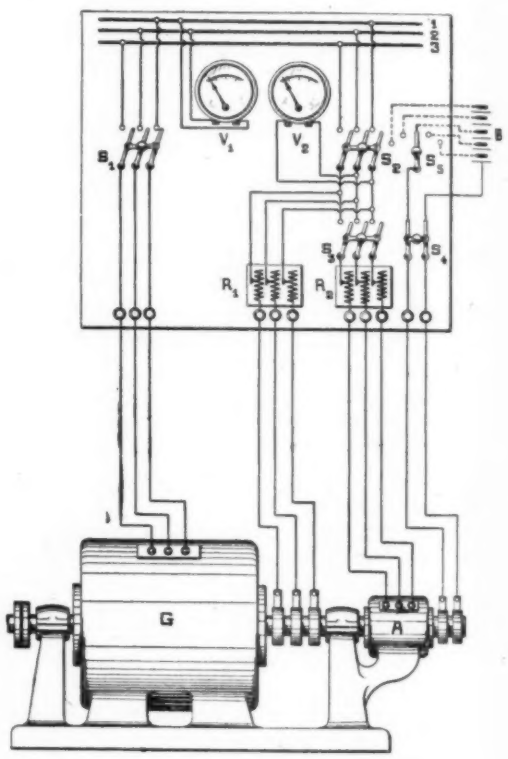

Fig. 1.—Self-exciting Alternator: Diagram of Connections.

means of the variable resistances R_1 and R_2, and it is indicated by the readings of the two voltmeters V_1 and V_2, the switch S_3 is closed and S_2 opened, leaving the generator G exciting its own field circuit, and the auxiliary alternator completely disconnected. The main generator and the auxiliary generator are shown built up on the same shaft, becuse it is possible by this arrangement to design the two generators in such a manner that they will always be in correct phasing. The auxiliary generator may, however, be separately driven when the synchronisation with the main generator will be made by trial and error.

Among the advantages which, it is claimed, would follow the use of this method of excitation in a power station are: (a) Simplicity and therefore lower first cost; (b) higher efficiency; and (c) easier synchronisation. With regard to the first, with the exception of the "master unit" shown in the diagram, all the generators will be of simpler form since they will not require d.c. exciting generators, being excited from the busbars. This means that the cost of each generator will be reduced, as also will the floor space which it

occupies, this being an important consideration in power stations laid down in towns. With regard to (b) the better efficiency will be due to the fact that the power required to drive the exciter is saved. In addition, the troubles usually associated with the exciters will be entirely eliminated.

Finally, with regard to (c), as the incoming machine is started with its field connected to the busbars, the frequency when the machine just begins to move is the same as that of the busbars, since $np/2=0$. As the speed rises, the frequency of the generated current becomes lower, until it is equal to zero. Then, on further increasing the speed, the frequency increases from 0 up to $np/4$, when the incoming generator runs at the same speed as the other generators for an equal number of poles. In the usual type of generator the frequency is $np/2$, as against $np/4$ in the self-excited machine, and then a small variation of speed only has one-half the effect on the frequency in the latter as compared with the former, and for the same reason the risk of losing synchronisation is reduced 50 per cent.

Some Notes on the Adjustment of Wages and the Cost of Living.

By K. C. B.

THE adjustment of wages in accordance with the variations in the cost of living, as compared with pre-war times, is a common feature in present-day agreements between employers and employed.

Such a method has much to commend it, although, on the other hand, much dissatisfaction is felt by a good number of the workers owing to the belief that the index figure as published in the *Labour Gazette* is not a true indication of the expenditure by the average worker.

Observers of the fluctuations in this index figure and of the causes to which these fluctuations are stated to be due, will have a measure of sympathy for those who do not consider that the index figure reflects the true conditions, but it is not the object of this article to deal with the accuracy or otherwise of the methods adopted to obtain the figure, but rather to give some little consideration to its application.

It is intended that the subject shall be dealt with on general lines, but owing to its nature, it is advisable to consider a concrete case, and the writer has therefore chosen one with which he is quite familiar, namely, the case of workmen in the electricity supply industry in the No. 9 Area.

Stated briefly, the agreement covering the adjustments in this area is as follows:—"For each six points rise or fall in the cost of living, wages shall be increased or decreased by ½d. per hour respectively, calculated from the datum figure of 120 points above pre-war."

The rates of pay for two grades at this datum figure were approximately 1s. 10¼d. and 1s. 5¼d. respectively, but when the cost of living had dropped to 72, the rates were automatically reduced to 1s. 6¼d. and 1s. 1¾d.

The percentage reduction in the cost of living is 21.8, while the reductions in wages are 18.0 per cent. and 23.2 per cent. respectively.

(It must be noted that although it is quite usual to speak of the cost of living as 120, this really represents the increase taking the pre-war as 100, so that in calculating the percentage reduction above, we must treat it as if the cost has dropped from 220 to 172, and not as from 120 to 72, which would be a much greater per centage.)

The above figures would seem to indicate that on the average the adjustments are reasonable, assuming always that there is no margin between the earnings of the workman and his cost of living.

A case has occurred recently, however, where the method of applying the adjustment has reacted unfavourably on the workmen concerned.

During the three months ending March, 1923, the average of the index figures was 77; as this was on a falling curve, the wages were adjusted to correspond with the figure of 78, this being the nearest figure which would give a complete six points variation. In the next three months the average figure dropped to 71, and a reduction in wages occurred calculated at the figure of 72.

After remaining at this figure for a further three months, it rose during the quarter ending December, 1923, to 75.7, and it was claimed that there was no change in wages because there was not a complete six points rise. If this is accepted, the result is curious. When the cost of living was at 77, the rate per hour for one of the grades taken above was 1s. 1¾d.; when it reached 71, the rate dropped to 1s. 1¼d., and now when it is at 75.7, which figure is the same as 77 so far as the adjustments are concerned, it is argued that the rate must be ½d. per hour less than when it was last at 77, a few months ago.

This is obviously an absurd state of affairs, and, moreover, is fundamentally wrong, because the agreement states that all adjustments shall be calculated from the datum figure of 120, which would make the rate the same as hitherto, viz., 1s. 1¾d.

As further proof of this, consider the case of an undertaking which, up to the present, has been a defaulter, but which, having now learned wisdom, has come into the N.J.I.C. and has agreed to accept its findings.

Since it has not previously paid schedule rates, the only datum figure from which it can calculate the adjustment necessary is that given in the agreement, namely, 120.

It is unthinkable that the District Joint Board should agree that undertaking "A," which is an old member of the Board, is correct in interpreting the schedule so that the rates paid by it are ½d. per hour less all round than those paid by undertaking "B," which has only just joined the Board, while admitting that the calculations of this latter undertaking are in order.

In conclusion, the writer wishes to point out that where he has quoted rates, these must not be considered as definitely applicable in all cases, for no notice has been taken of a super cut which operated some months ago, and which would in some instances modify the figures given.

Appended is a table showing variations in the rates of pay as the cost of living alters, when calculated from datum figures of 120, 96 and 72 respectively.

Index figure.	Rates per hour. Datum 120.	Datum 96.	Datum 72.
132-126	1/5	1/5	1/5
126-120	1/4½	1/4½	1/4½
120-114	1/4½	1/4	1/4
114-108	1/4	1/3½	1/3½
108-102	1/3½	1/3	1/3
102-96	1/3	1/2½	1/2½
96-90	1/2½	1/2½	1/2
90-84	1/2	1/2	1/1½
84-78	1/1½	1/1½	1/1
78-72	1/1	1/1	1/0½
72-66	1/0½	1/0½	1/0½
66-60	1/0	1/0	1/0

The British Empire Exhibition.

Further Lists of Exhibitors.

IN our issue of June 1st, 1923, we reproduced preliminary lists of firms who are exhibiting at the Wembley Exhibition which is to be opened in April. We have now received what are practically the final lists, and from these we have taken the names of firms who did not appear on the last occasion. It will be seen that the additions make the Exhibition thoroughly representative of British engineering—in fact, it is safe to say that never in the history of the industry has there been such a coming-together of engineering undertakings. Perhaps the most notable addition to the list of those in the Electrical Engineering Section is the British Electrical Development Association, whose exhibit will prove most attractive to the general public upon whose support the success of the Exhibition mainly depends. The British Electrical and Allied Manufacturers' Association will have an office in the Palace of Engineering, which will be of great convenience to everybody. The exhibitors under the heading "Miscellaneous" will be found in the Palace of Industry; all the others will be in the Palace of Engineering.

Exhibitors in the Electrical Engineering Section.

Automatic Coil Winder and Electrical Equipment Co., Ltd.
Automatic Telephone Manufacturing Co., Ltd.
Belling, C. R.
Benjamin Electric, Ltd.
Best & Lloyd, Ltd.
British Electric Plant Co., Ltd.
British Electric Vehicles, Ltd.
British Electrical & Allied Manufacturers' Association.
British Electrical Development Association, Incorp.
British Engine, Boiler and Electrical Insurance Co., Ltd.
British Engineering Units, Ltd.
Bruce Peebles & Co., Ltd.
Calvete, I., Ltd.
Cambridge & Paul Instrument Co., Ltd.
Cole, Marchent & Morley, Ltd.
Crossley Bros., Ltd.
Davey, Paxman & Co., Ltd.
De la Rue, Thomas, & Co., Ltd.
Dowsing Radiant Heat Co., Ltd.
Electric Construction Co., Ltd.
Electrical Installations, Ltd.
Empson Centrifugals, Ltd.
Falk, Stadelmann & Co., Ltd.
Foster Instrument Co.
Galloways, Ltd.
Graham, Alfred, & Co.
Harland Engineering Co., Ltd.
Indo - European Telegraph Co., Ltd.
K.E.M. Engineering Co., Ltd.
Macintosh Cable Co., Ltd.
Morgan Crucible Co., Ltd.
Mullard Radio Valve Co., Ltd.
Musgrave, John, & Sons, Ltd.
National Gas Engine Co., Ltd.
Neon Lights (1923), Ltd.
New Pelapone Engine Co., Ltd.
Pacific Cable Board.
Paxman Locomotive Valve Gear Co., Ltd.
Radio Communication Co., Ltd.
Reason Manufacturing Co., Ltd.
Rheostatic Co., Ltd.
Rotax (Motor Accessories), Ltd.
Sheringham Daylight, Ltd.
Tyer & Co., Ltd.
Vandervell, C. A., & Co., Ltd.
Venner Time Switches, Ltd.
Wakefield, C. C., & Co., Ltd.
Waygood-Otis, Ltd.
Worthington-Simpson, Ltd.

Exhibitors in Motor and Cycle Section.

A.C. Sphinx Sparking Plug Co., Ltd.
Benjamin Electric, Ltd.
Best & Lloyd, Ltd.
Boyce Motor Accessories, Ltd.
Bristol Tramways & Carriage Co., Ltd.
British Ignition Apparatus Association, Ltd.
British Lighting & Ignition Co., Ltd.
Chloride Electrical Storage Co., Ltd.
Lodge Plugs, Ltd.
Rotax (Motor Accessories), Ltd.
Vandervell, C. A., & Co., Ltd.

Exhibitors in the Shipbuilding, Marine, Mechanical and General Engineering Section.

Aiton & Co., Ltd.
Allen Hydrostatic Pump Syndicate, Ltd.
Anglo - Swedish Electric Welding Co., Ltd.
Angus, George, & Co., Ltd.
Armfield, J. J., & Co., Ltd.
Bassett-Lowke, Ltd.
Beck & Co., Ltd.
Bentall, E. H., & Co., Ltd.
Blackstone & Co., Ltd.
Bloom, Maurice Bart.
Bristol Aeroplane Co.
British Arca Regulators, Ltd..
British Engineers' Association (Incorp.).
Brown Bayley's Steel Works, Ltd.
Butterley Co., Ltd.
C.A.V. Small Tools, Ltd.
Changeable Sign Co., Ltd.
Cochran & Co., Annan, Ltd.
Cochrane, John (Barrhead), Ltd.
Consett Iron Co., Ltd.
Constantinesco, George.
Cussons, G., Ltd.
Denham, R. Iveson.
Drummond Bros., Ltd.
Emmott & Co., Ltd.
Ferodo, Ltd.
Francois Cementation Co., Ltd.
Gardner, L., & Sons, Ltd., and Norris, Henty and Gardners, Ltd.
Hampton, C. & J., Ltd.
Herbert, Alfred, Ltd.
Hobdell, Way & Co., Ltd.
Hopkinson, J., & Co., Ltd.
Howard & Bullough, Ltd.
Hydrogen, Oxygen & Plant Co., Ltd.
Instone, S., & Co., Ltd.
International Channelling Machines, Ltd.
Kenyon, William, & Sons, Ltd.
Magnetic Separators Co.
Manor-Powis Coal Co., Ltd.
Marine & Locomotive Superheaters, Ltd.
Mason, H. L.
Mellowes & Co., Ltd.
Merryweather & Sons, Ltd.
Monk Bridge Iron & Steel Co., Ltd.
Ransome Machinery Co. (1920), Ltd.
Ransomes & Rapier, Ltd.
Reddaway, F., & Co., Ltd.
Rendle, W. Edgcumbe, & Co., Ltd.
Richardsons, Westgarth & Co., Ltd.
Ruscoe, John, & Co., Ltd.
Russell, John, & Co., Ltd.
Salter, George, & Co., Ltd.
Semet-Solway & Piette Coke Oven Co., Ltd.
Steel Company of Scotland, Ltd.
Stott, James, & Co.
Transport (1910), Ltd.
Trist, Ronald, & Co., Ltd.
United Flexible Metallic Tubing Co., Ltd.
United Water Softeners, Ltd.
Valor Co., Ltd.
Wailes Dove Bitumastic, Ltd.
W.A.L. Coal Cutter, Ltd.
Walker, James, & Co., Ltd.
Wallsend Slipway Engineering Co., Ltd.
Ward, Thos. W., Ltd.
White, Child & Beney, Ltd.
Willcox, W. H., & Co., Ltd.
Williams & James.
Wright, Alexander, & Co., Ltd.
Yarrow & Co. (1922), Ltd.
Young's Patent Hygienic Bin Co.

Miscellaneous.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
London Electric Railway Co.
Ozonair, Ltd.
Princes Electrical Sure Time Clocks, Ltd.
Rawlplug Co., Ltd.
Relay Automatic Telephone Co., Ltd.

Electrical Pumping Plant.—An electrical pumping plant for the Newcastle and Gateshead Water Company's station at Benwell, on the outskirts of the city, has just been put into operation. The new plant consists of electrically-driven centrifugal pumps, and is to supersede the old compound and triple-expansion steam-driven pumps. It consists of eleven pumping sets, with a total pumping capacity of 14,000,000 gallons per day. From the Benwell station the water is pumped to the Fenham reservoir a height of 210 feet, whence the higher parts of the city are supplied. The contractors for the work were Messrs. E. N. Mackley & Co., of Gateshead, and it has been carried out under the superintendence of Mr. A. Hardcastle, M.Inst.C.E., the company's engineer. Power is supplied from the mains of the Newcastle-on-Tyne Electricity Supply Co., at a pressure of 6,000 V, which is transformed down to 3,000 V. To avoid any possibility of breakdown all the high-pressure plant is in duplicate, and the current is brought through two separate feeders which are connected with double switchgear.

Fires.—An outbreak of fire occurred on January 28th in the basement of the premises of Messrs. Shoolbred & Connell, electrical engineers, of Langley Street, Luton (Beds.). Damage was done to the stock by fire, smoke and water. On January 30th a fire occurred in Laygate Lane, South Shields, which completely destroyed two shops. One of these belonged to a tobacconist; the other was occupied by Mr. G. Gompertz, a contractor and dealer in electrical and radio apparatus.

Electro-Farming in Russia.

Lenin's Interest in Electricity as a Social Power.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E., A.M.I.C.E., F.R.Ae.S., Chartered Civil Engineer.

One of Lenin's great visions was to see the whole of his country electrified. He early realised that whatever might be the natural resources of a country, she could not hold her place in the world unless she had the mechanical equipment for developing those resources. Further, this equipment should preferably be ahead of the practice of the world, for it is always better to lead than to follow. It is not the copyists who succeed.

As the result of consultations with experts, Lenin decided upon the policy of arranging to supply electricity to farmers, as electricity was the form of power that would best meet their circumstances. To this end he appointed an Engineering Commission, consisting of the leading electrical, civil, hydraulic, and mechanical engineers. This commission corresponds to the British Electricity Commissioners, but the Russian engineers have very much more power. The rural distribution schemes are, of course, interlinked with the urban undertakings. In addition, Lenin appointed a special Commission to deal with the special applications of electricity to agriculture. This was a very farsighted move, for the weak point in every country at present is that the electrical engineers do not fully understand the farmers' problems, and the farmers do not comprehend the nature of electricity supply. This is a very simple matter apparently, but only those who have investigated the subject as carefully as the present writer can realise the inherent difficulties of proper co-ordination. The average electrical engineer is apt to lightly dismiss the question of using electric motors on farms, as merely the trifling one of belting up a standard industrial motor to a farm machine—wherein he is greatly mistaken, as so many Continental engineers have discovered to their cost, having been obliged to develop special motors for agricultural use. Hence, Lenin's attitude on the same question is to be highly commended.

The Germans reaped most of the advantage of Lenin's electro-farming enterprise in the earlier days, but Germany's financial and industrial position is such to-day that already one hears of important orders being placed with British and Czecho-Slovakian firms. No British firm has as yet (so far as the writer is aware) constructed any electric motors that are suitable in both design and price for agricultural work. However, it will not be long before they recognise the importance of this new field. It already provides an enormous output for the Continental electric motor manufacturers, who have taken the trouble to prepare special designs for this new application of electricity.

Thanks to Lenin, there are probably more electric ploughs at work in Russia than in any other country. This is a very important application of electricity, as the consumption of energy is large and steady over a long period of the year. Again, what are probably the largest thrashing machines in the world are at work in Russia. They require about 150 h.p. each to operate, and the work they are capable of handling in a day is simply colossal.

The president of both the Russian Commissions has personally visited the writer's farm (as he has done the principal electrically-operated farms in other countries) with the view of seeing if there is anything that can be adapted to Russian conditions—and it is perhaps of interest to state that England could teach the Russians something in electro-farming, notwithstanding the now considerable experience of their unhappy land.

In spite of the extreme pressure of his public duties, Lenin frequently inspected new and improved electrical installations on farms—such was his great interest in the matter. The commencement of his recent lengthy illness was attributed in the first place in the newspaper Press as being the outcome of being shot at by a peasant girl during one of his electric farm inspections. From private inquiries, however, the writer finds this report (like so many others in connection with Russian affairs) to be without foundation.

Nikolai Lenin, as will have been gathered from the above notes, carried out a great work to the advantage of agriculture (and to electricity) which will be ultimately of benefit to the whole world. For agriculture is the greatest industry in every country, and it is the keystone of the success of every nation.

The Position of the Colliery Engineer.

In his letter on this subject, which appears on p. 239, Mr. W. T. Anderson places the responsibility for deciding when compulsory certification becomes necessary on the shoulders of the Government; but what is his personal opinion? Although he dismisses the "pursuit of 'ocean liners'" as having nothing to do with the case, it is recorded in the official journal of the Association—a very excellent journal, by the way—that at a meeting of the Yorkshire Branch, on November 24th, 1923, the chairman, referring to the status of the mining electrical engineer, said "there had been some discussion in the Branch as to whether the Mines Department should be approached, through the Association, with a view to certificates being granted to mining electrical engineers as to other officials." Evidently, at least some members of the Association think as we do. Mr. Anderson, present in his capacity as president, was invited to give his opinion, and stated that "he had held very strongly for many years that it was somewhat of an anomaly that the colliery electrician did not hold his 'ticket' of competency, *just as it had to be held by the marine engineer*. Their Association was the only body which had set up machinery to test the qualifications of mining electrical engineers, and it was possible that the Mines Department might, sooner or later, approach them to make use of that machinery. If they did, so far so good. It would be a red letter day in the history of the Association." (The italics are ours.) He demurred, however, to the Council's approaching the Mines Department, as encouraging a spirit of trade unionism, with which the Association could not have anything to do.

If, therefore, we have erred, as Mr. Anderson tells us, in drawing a parallel between colliery electricians and marine engineers, we have erred in good company.

In the discussion which followed the president's remarks, Mr. Williams—the original founder and first secretary of the Association, we believe—advocated "official recognition of some certificate"; he pointed out that "the colliery electrician was compelled by the Regulations to carry out certain tests, and many of the men he had come in contact with—perhaps he had been unfortunate in his experience—had been incapable from the point of view of technical training, of carrying out those tests in an efficient manner." He went on to state that an official of the Mines Department, when asked if he

was in favour of certification, said "Yes." When "asked why nothing had been done, the official replied: 'You have never pressed the demand.'" The chairman also observed "that there certainly was a strong feeling amongst many members of the Branch that it would be better if there were a certificate to show that a man was competent"; they did not wish to limit certification to members of the Association, and "that was the difference between the idea of that Association on the matter and the trade union point of view."

Mr. Williams further urged that if a deputy had to have a Government certificate, still more should the colliery electrician be certificated, and Mr. Anderson said: "I think we are all agreed on that." Mr. Williams said: "We should make the claim more on the ground of safety than anything else, that certificates are desirable"—and that is our point.

Reference to our issues of 1909 would show that when the Association was formed "one of the main ideas the founders of the organisation had in their minds was to do something in the direction of improving the status of mining electrical engineers" (we quote again from the *Mining Electrical Engineer*, the words of Mr. David Martin, chairman of the West of Scotland Branch, at a recent meeting). Mr. J. Williams's first letter (ELECTRICAL REVIEW, February 12th, 1909, p. 245) suggested that the Board of Trade should issue certificates "as they do to marine engineers," and that a society should be formed "of competent men, framing the rules so as to ensure that they shall be thoroughly experienced and hold a certificate as a guarantee of competency." We had already, in our issue of December 11th, 1908, advocated the formation of an Association of Colliery Engineers, describing it as "a most important and pressing question." We adhere to our "second contention," and it will be noticed that no manager, agent, or representative was numbered amongst the ten signatories to the memorandum. They came in afterwards—to control this new association. Mr. Anderson's inferences, his reiterations that the Government will act when it thinks fit, and his view that certification means trade unionism, may be left, as he says, to our readers' judgment. We hold that the Government would act if pressed by the Association; that the time is more than ripe for action; and that it is the duty of the Association to press the Government, in order that none but competent men may be placed in charge of the lives of men underground.

The French Physical Society's Exhibition.

IN December last the French Physical Society celebrated its fiftieth anniversary, and held an exhibition of scientific apparatus, which was visited by an extraordinarily large number of people (over 26,000 on Sunday, December 2nd!) The exhibits covered an exceptionally wide range and included many intresting features, a number of which are briefly described below.

The Carpentier Telegraph Printer.

The machine which is illustrated below (fig. 1) is a new type of printing telegraph developed by the firm of Carpentier, which instead of printing as usual on a paper tape, prints the message line by line upon a sheet of paper—thus avoiding the delay and inconvenience involved in gumming the tape on a sheet. The speed of transmission depends upon the skill of the operator, who uses a keyboard like that of a typewriter.

New Lighthouse Controller.

An automatic device for the code lighting and extinguishing of a lighthouse lamp has been devised by M. A. Blondel, and is illustrated in fig. 2. Novel arrangements are made for varying the periods of illumination and extinction in accordance with any distinctive code; for example, it could give three flashes of 2 seconds each separated by two eclipses of 3 seconds each, the group being followed by an eclipse of much longer duration, such as 6 seconds, or the signal might take the form of short eclipses separated by flashes and followed by a long period of illumination.

These results are obtained by means of a cam driven by the last wheel of the apparatus, which opens and closes the lamp circuit, the total duration of the cycle corresponding to one complete revolution of the cam. The interrupter actuated by the cam is a glass tube containing mercury in a hydrogen atmosphere; the mercury makes contact with two platinum wires sealed into the ends of the tube, which is tilted by the cam. This well-known type of interrupter is particularly suitable for use near the sea coast, as it is completely free from risk of oxidisation of the contacts and requires no attention or maintenance.

The spindle of the cam is driven by a small electric motor fed from a lighting circuit, through a train giving two reductions of speed, enabling the speed of the cam to be varied over a wide range without changing the speed of the motor. The profile of the cam, of course, is chosen to suit the code of flashes that is to be used.

A Chronometric Tuning-fork Motor.

M. A. Guillet, a professor at the Sorbonne, has devised the apparatus shown in fig. 3, which is a true chronometer, in which the motive power is derived from an electric tuning-fork, the latter simultaneously regulating the rate. Each prong of the fork carries a little cylindrical pawl which engages with the teeth of one of two wheels, fixed on the same spindle, but displaced with regard to one another by half a tooth. When the fork vibrates, one of the pawls engages with a tooth of the corresponding wheel, whilst the other disengages; at each complete vibration the wheels advance one tooth, being prevented from over-running by the friction of the pawl which is moving in the opposite sense. The frequency of the fork being known and the number of teeth in the wheels being chosen to correspond with it, the wheels revolve continuously at a known rate—say, one revolution per second. The forces at work are sufficiently great to enable the clockwork to carry a relatively heavy load external to the apparatus, thus providing a true "chronometric motor."

One of the most important applications of the device is to maintain rigorous synchronism between apparatus fixed at different stations. By connecting in shunt with the contact of one of these motors the electromagnet of a similar motor fed at a frequency approximating to that of the first, the second will vibrate exactly in synchronism with the first, and thus at various places the same operations can be performed at precisely the same instant. Another use is to measure exactly the difference of phase between periodical phenomena, such as, for instance, the beats of pendulums in different observatories.

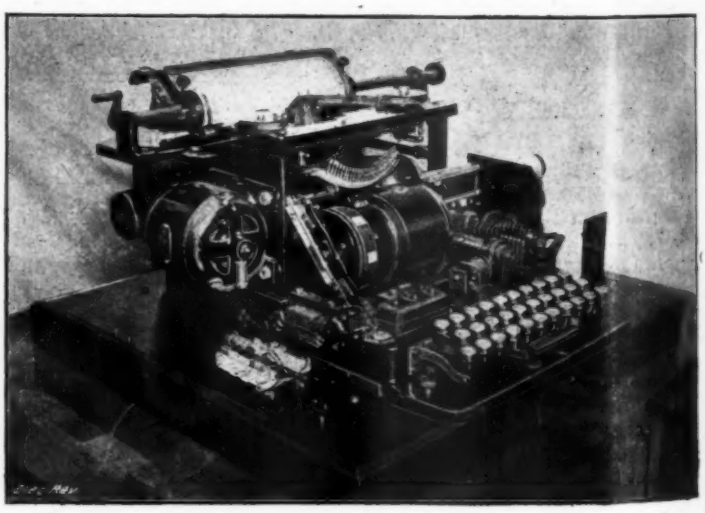

Fig. 1.—The Carpentier Telegraph Printer.

The Dufour High-frequency Furnace.

In the Dufour furnace, which is illustrated in fig. 4, all the elements necessary to its operation are grouped inside a metallic cabinet connected to earth so as to prevent accident to the apparatus or to the operator. The controlling and

regulating devices are grouped on a panel in front of the apparatus, the furnace itself being seen in the figure, fixed on a bracket at the right-hand side.

The equipment includes a transformer supplied with current at 50 cycles, 110 volts, and giving high-pressure current on the secondary side. Behind the panel and above the transformer is a battery of condensers immersed in oil contained in two metal tanks. Above these again is a rotary spark-gap driven by a small motor at 3,000 r.p.m. The spark plays between two graphite electrodes and a rotor carrying fins which produce a blast to extinguish the spark; the interior of the sparker is entirely closed and contains an atmosphere of alcohol vapour.

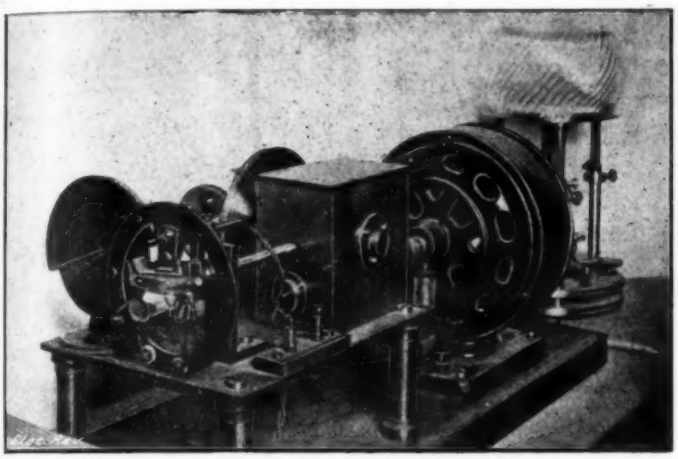

Fig. 2.—Blondel Lighthouse Controller.

The furnace consists of a sleeve of moulded silica carrying an inductive winding provided at each end with a terminal and flexible connection leading to the high-frequency circuit. The crucible is placed inside the furnace and can itself be of conducting material, or of refractory material if the charge is conducting. The whole is seated in a bed of magnesia, zirconia, lampblack, or other heat insulator.

With a nominal power of 3 kW one can obtain in a crucible of 70 cm.³ capacity a temperature of 2,000 deg. C. in about 20 minutes; a kilogram of platinum can be melted in an hour.

New Variable Condenser.

A condenser, invented by M. Baringolz, consists of sets of concentric metallic cylinders, as shown in fig. 5, and can be made very cheaply. Both sets of cylinders are movable, that on the right being capable of quick motion, whilst that

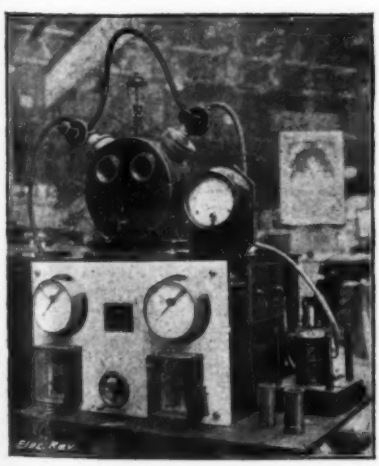

Fig. 4.—Dufour High-frequency Furnace.

on the left can be adjusted by means of a double micrometer screw giving very fine adjustment; the scales are graduated in units of capacity, and are said to enable a variation of one-millionth of the total capacity to be read. It is claimed that the change of capacity proceeds in accordance with definite laws, and that the residual capacity is extremely small; also, that all the condensers of this type and of the same size are identical in performance. On the same principle of construction larger apparatus can be made for very high pressures.

The illustration shows on the right hand a laboratory pattern, and on the left a type suitable for radio amateurs.

(To be continued.)

Legal.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

IN the Chancery Division, on January 28th, Mr. Justice Russell gave judgment in the action brought by the British Thomson-Houston Co., Ltd., already reported in our pages.

His LORDSHIP, in the course of his judgment, said the defendants denied infringement, and alleged the invalidity of the letters patent. Dealing with the defence of want of

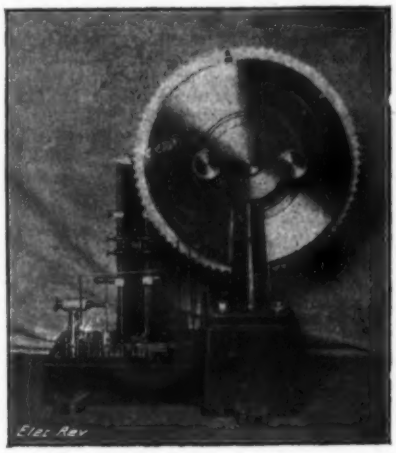

Fig. 3.—Guillet Tuning-Fork Motor.

novelty and want of subject matter, his Lordship said that plaintiffs' patent claimed a new product, namely, a body of mechanically-worked tungsten which was ductile cold, and a method of producing it by repeated working of the tungsten when heated to a proper temperature. Squirted tungsten was in use until 1911 or 1912, but it had many disadvantages.

In 1906 the plaintiffs obtained grant of letters patent for a method of working tungsten in a coherent form while hot into filaments for lamps, but until after the publication of the 1909 patent a drawn tungsten wire or filament or a drawn body of tungsten was unknown.

Examining the patent in question, his Lordship said the specification showed that repeated mechanical working of the tungsten while hot produced a body which was ductile cold, and which was very fibrous instead of crystalline. There could be no doubt on the evidence that before the publication of this patent no one had produced a body of tungsten ductile cold nor had anyone produced a drawn tungsten wire fila-

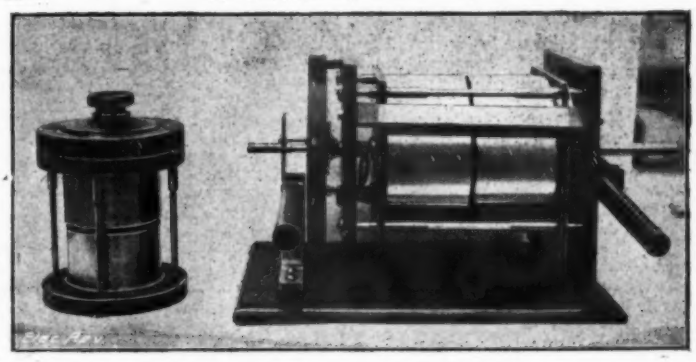

Fig. 5.—Baringolz Variable Condenser.

ment. Nor could there be any doubt on the evidence that by following the directions given as to rolling or swaging, followed by drawing, one could produce, not only a drawn wire or filament, but one which was ductile cold.

In view of the state of knowledge on the subject in 1909 he had no doubt that unless the 1906 patent altered the position the 1909 invention was proper subject matter for a patent. The specification disclosed both a new product and a process for producing it, and it was admitted that it was the only document which set out that process.

It was said, however, that an individual who was referred to as "a competent manufacturer," or "the practical man," or "an intelligent person," would require to add nothing to

what the 1906 patent told him in order to achieve the results of the 1909 patent. As to the 1906 patent, it was not surprising to find that the Courts had decided that it was invalid for want of subject matter. How far did that patent disclose the features of the 1909 patent? As to the product being ductile cold there was no indication that the tungsten worked under the 1906 patent would be ductile cold, for it had to be re-heated to be rendered ductile.

As to the repeated mechanical working, there was no indication of this feature in the earlier patent, for it said nothing as to the change of the structure of the metal from the crystalline to fibrous. As to the temperature of working, no temperature was specified in the 1906 patent except dull red, a temperature far below the 1,300 degrees specified in the later patent and admittedly insufficient. In his opinion there was no disclosure in the 1906 patent of the invention covered by the 1909 patent. But it was said that a competent person, without any inventive ingenuity, and applying only the routine and tools of the metal worker, could, by working under the 1906 patent, produce tungsten ductile cold. In other words, that he could ascertain the proper temperature for working and the proper steps for reduction. The plaintiff, on the other hand, contended that the 1906 patent was unworkable, and that if one followed its instructions one could produce nothing. It was evident that if one followed the instructions of that patent as to temperature and the number of steps in working, failure must be the result, and he was tempted to inquire why if, as alleged, it were possible to achieve success by the 1906 patent, no one had ever done so.

For the reasons given he was satisfied that the 1906 patent did not disclose the 1909 invention; that the latter was proper subject matter for letters patent and that the defence of want of novelty and want of subject matter failed. In other words, the plaintiffs, by the 1909 invention, solved a problem which had hitherto defied solution.

It was a curious fact that in 1916 the plaintiffs commenced an action against the Duram Co. for infringement of the 1906 patent, and contended that, by following the directions given, a drawn tungsten filament could be obtained. That circumstance was, no doubt, some embarrassment for the plaintiffs, though it was fair to say that their principal expert, Dr. Oberlander, had all along taken the view that the 1906 patent disclosed no workable process.

As to the defence that the specification of the 1909 patent was insufficient and misleading, it was said that insufficient directions were given as to the amount of working and degree of heat necessary for the rolling, but, in his opinion, there was no insufficiency. It was also said that it was impracticable to draw direct, but evidence was given that it could be done and that ground of defence failed.

The next defence was the allegation that the invention was not only not useful, but the evidence appeared to be all the other way. There remained the question of infringement. The defendants imported a wire 28 mils in diameter, and this they drew down to about 1¼ mils. This 1¼-mils wire they put into their lamps and it was undoubtedly ductile cold. After subjecting these wires to microscopic examination Dr. Oberlander had no doubt that they had been produced by the process described in the plaintiffs' specification, and indeed, that would seem to be so seeing that no other process for the purpose was known. The defendants were in this dilemma: if the wire which they imported was ductile cold they had used an infringing article. If it were not they had produced an infringing article by completing the patented process (begun elsewhere). The defendants further suggested that they had acquired the wire from licensees of the plaintiffs. But that was never pleaded, and he would have thought that the defendants ought to have proved it and not to have occupied a large amount of public time attacking a patent under which they claimed to be licensees. The defence of no infringement failed, and in the result the plaintiffs were entitled to an injunction on an inquiry as to damages and an Order for delivery up of all infringing articles and the costs of the action. The counter-claim would be dismissed with costs.

It had been suggested that Dr. Oberlander's evidence was unreliable, but in his (the Judge's) opinion he gave his evidence honestly and fairly. He was a witness with profound knowledge of his subject, and upon whose evidence the Court might safely rely.

Sir ARTHUR COLEFAX, K.C., for plaintiffs, asked for costs on the higher scale on the ground that the case was of great importance.

His LORDSHIP said he would leave the costs to the taxing master.

Sir DUNCAN KERLY, K.C., for the defendants, asked for a stay of the injunction pending appeal and offered to bring £10,000 into Court to cover any possible damages. He said that to stop the defendants' business would be very serious.

After some argument his Lordship granted a stay until the hearing of the appeal on condition that notice of the appeal was given in a fortnight and £10,000 was brought into Court by the defendants.

False Pretences Charge.

ON January 21st, at the Cambridge Borough Court, Charles Gwilliam was charged with having obtained £1 5s. from Mr. William Munday by false pretences, and also with obtaining the sum of £1 by the same means. On the first charge Mr. Munday stated that he was an electrician, and he advertised in the ELECTRICAL REVIEW for a situation. Prisoner replied to the advertisement, offering him a position with a firm of contractors, with whom, however, defendant had no connection. Prisoner obtained 25s. from witness as "expenses," and asked for a further 30s., and witness sent him £1. Failing to secure satisfaction witness notified the police and prisoner was arrested. Prisoner pleaded guilty and, previous convictions having been proved against him, he was sentenced to three months' imprisonment on each charge, the sentences to run concurrently.

Theft of Electricity.

AT the Spennymoor Court, on January 29th, Edwin Rhodes was charged with the theft of electricity from the mains of the Northern Counties Electricity Supply Co., Ltd. An inspector stated that two needles had been inserted in the leading-in wires prior to their entry into the meter, and to these wires had been connected. A fine of £5 and costs was imposed.

Shipowner Fined.

ON January 30th the hearing of the charge against Edward Olivier for failing to provide a wireless telegraph installation on the ship *El Kantara* (reported in our issue of January 25th) was proceeded with. It was stated by Mr. PERCIVAL CLARKE, for the Director of Public Prosecutions, that the *El Kantara* was a vessel of over 1,600 tons gross displacement, and consequently came within the scope of the Merchant Shipping Wireless Telegraphy Act, 1919, which required all ships above this tonnage to be equipped with apparatus for sending and receiving wireless signals. The ship was proceeding to the Pirœus to be sold in July, 1923, and on the voyage was lost with all hands.

Defendant, as principal owner, was found guilty of contravening the Act, and the Recorder of London imposed a fine of £200, and ordered defendant to pay a sum not exceeding £50 towards the cost of the prosecution. The Judge said that this appeared to be the first case of the kind to come before a Court of Assize. The shipwreck was in no way due to the absence of a wireless installation, but the defendant had saved his own pocket by wilfully refusing to comply with the regulations.

Madras Electric Supply Co., Ltd., v. Peninsular & Oriental Steam Navigation Co.

THE Court of Appeal, consisting of Lord Justices Bankes, Scrutton, and Sargant, on January 31st, heard an appeal by the Madras Electric Supply Co., Ltd., from a judgment of Mr. Justice Bailhache in favour of the Peninsular and Oriental Steam Navigation Co.

The appellant brought the action to recover damages for the alleged failure by the defendants to fulfil their obligations to carry and discharge electric plant from London to Madras. The appellants' case was that they had contracted with the defendants for the carriage to, and delivery of, the plant at Madras, and in consequence of the alleged negligence of the defendants or their servants a stator (part of the plant shipped), which weighed about 25 tons, whilst being unloaded, fell on to the deck of the ship and thence into the sea, and was very seriously damaged.

The appellants based their claim on the alleged unseaworthiness of the vessel, and the alleged unseaworthiness was said to consist of the fact that the vessel was not properly and sufficiently equipped for unloading goods of that weight, and that, in the circumstances, there ought to have been an additional backstay provided.

Mr. Justice BAILHACHE held that the appellants had failed in their plea as to the unseaworthiness of the vessel, and that in any count the defendants were protected by the exceptions contained in the bill of lading. In case he was wrong he assessed the damages at £4,242.

The Lords Justices now affirmed the decision of Mr. Justice Bailhache that the action failed, and the appeal was accordingly dismissed, with costs.

Harris v. Dinshaw.

IN this action, which was heard by Sir Edward Pollock, one of the High Court Official Referees, on January 31st, the plaintiff, Mr. Thomas Archibald Harris, an electrical engineer, carrying on business as the Electrical Specialist Co., at 20, St. John's Church Road, Hackney, claimed from Dr. Dinshaw and his wife £254 balance of charges for electrically fitting their house at 57, Darnley Road, Hackney.

It appeared that early in January of last year the plaintiff was introduced by an acquaintance to the defendant, who asked him to give an estimate for certain electrical work. The estimates were sent, and as a result the plaintiff was instructed to do the work, in the course of which instructions were given by both defendant and his wife to do work in addition to that estimated for. When the work was completed, the doctor expressed himself satisfied with it. Invoices were sent in, and defendant paid £28 on account, and subsequently another £20 was paid. But when plaintiff pressed for further payment, the defendant disputed the account, and when action was taken to recover the balance, defendant denied indebtedness, asserting that the charges were excessive,

that the work had not been completed, and that claims were made for articles that had not been supplied.

Defendant also counterclaimed damages for breach of contract, but the borough officials passed the work before it was connected up.

Several witnesses were called in support of the plaintiffs' case, and in the result the Official Referee gave judgment for the plaintiff against both defendants for £236 13s. 11d., with costs. He also gave judgment in favour of the plaintiff on the counterclaim.

Park Royal Engineering Works, Ltd.

In the Companies Winding-up Court, on January 18th, Mr. Justice Eve heard the petition of the Aston Chain & Hook Co., Ltd., for the compulsory winding-up of the above company.

Counsel for petitioners stated that the matter had been before Mr. Justice Romer, and had been ordered to stand over for a scheme to be prepared. An affidavit had been filed showing that the scheme had not been completed. He understood that the company now desired a further adjournment for two or three months, but his instructions were to ask for a compulsory winding-up order at once.

Mr. TURNER, for the company, and for creditors for over £3,000, opposing the petition, stated that the petitioning creditors' debt was only for £227, and therefore there was an overwhelming majority against a winding-up order.

Counsel for petitioners said their debt was for £227, in respect of goods sold and delivered.

His LORDSHIP observed that the company had a nominal capital of £40,000, and there were mortgages for £30,000. He would grant a compulsory winding-up order.

Woods v. Cable Accessories Co., Ltd.

In the Chancery Division, on January 30th, the case of Richard Stewart Woods, of Longsight, Manchester, against the Cable Accessories Co., Ltd., of Tipton, Staffs., was mentioned to Mr. Justice Romer.

It related to a dispute with regard to the plaintiff's letters patent for electrical earthing devices.

His Lordship, however, was informed that it would not be proceeded with, as it had been settled on terms endorsed on counsel's briefs.

Radio-telephony in a Public House.

At the Marylebone County Court, on January 25th, before Judge Scully, Manufacturing Engineers, Ltd., of Gray's Inn Road, W.C., sued William Thomas Creswell, a publican, for the sum of £34 16s. 6d., balance of cost of a broadcasting receiving set installed by the plaintiffs in defendant's public house. For the plaintiffs it was stated that early last year they received an order for a four-valve set with two loud speakers, which was to reproduce broadcast matter so as to be audible in all the bars of the public house. When the installation had been in use for five or six months defendant claimed that the results were indistinct, but he paid £50 on account of the total cost, £84 16s. 6d., on condition that the set was put right.

Plaintiffs called witnesses, who stated that the results were quite distinct, but defendant also called experts, who testified to the contrary. Defendant said that the set was to be sufficient to provide music, &c., for the whole of the six bars of his establishment, but it failed in this respect. One of his witnesses gave it as his opinion that the transformers were unsuitable, and that to put the set right would involve an expenditure of £30.

Judge Scully eventually gave judgment for plaintiffs for the amount claimed, with costs.

Mexican Electrical Developments.—The British Consul-General at Mexico City points out in his recent report that, in addition to the electrical machinery required by the various Mexican power and transportation companies, there is also a demand for smaller electrical products, such as low power dynamos and household equipment. Low power petrol and gas engines, too, are imported to a certain extent. He reports that towards the end of 1922, the Mexican Railway Company undertook the electrification of a portion of the line between the capital and Vera Cruz; the work being entrusted to an important American company. This company has supplied 10 electric locomotives, each weighing 150 tons, to haul trains of 300 tons over a section of line, 20 miles in length, where the ruling gradient is 4½ per cent. The same firm will carry out the work of construction and supply all necessary material. The electric power will be provided by the Puebla Tramway, Light and Power Company, which has its generating plant a few miles distant from the lines of the railway company. It is hoped that the electrification will be completed during 1924.

Czecho-Slovakia and Imported Lamps.—An order was issued by the Czecho-Slovakian Government providing that as from January 2nd last no import licences were necessary in respect of the importation into the country of bulbs for electric incandescent lamps.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Adjustable Plugs, Sockets, &c.

As an alternative to the use of a standard plug and socket the devices produced by MESSRS. WILLIAM ALLAN & Co., 62, Dale Street, Liverpool, appear to be the next best thing. In the two-pin socket made by the firm one of the sockets is adjustable within a range of 3-16 in. As will be seen from the illustration (fig. 1) a small slot is cut in the head of the socket, and by this means the whole can be turned with a screwdriver or coin. Fig. 2 illustrates a two-pin plug, and this

Fig. 1.—Adjustable Wall Socket.

Fig. 2.—Adjustable Two-Pin Plug.

again is provided with one adjustable pin. The idea, which is also applied to adaptors and lampholders, is an excellent one, but we think that the usual "safety" features of the ordinary designs should have been retained. The socket terminals are exposed, and in the plugs no provision is made for taking the strain from the terminals, which leads to the danger of pulled-out connections.

The Lyrianette Radio Receiver.

A new product of MESSRS. RADIO INSTRUMENTS, LTD., of 12, Hyde Street, New Oxford Street, W.C.1, is the radio receiver illustrated in fig. 3. The instrument is designed for broadcast wavelengths only and comprises, in the case of the two-valve pattern, one detector with aerial reaction followed by one l.f. valve with an R.I. transformer. In the case of the three-valve set there are two stages of l.f. amplification and two

Fig. 3.—The Lyrianette Receiver.

transformers. The volume of sound produced by the two-valve model is said to be sufficient for a good-sized drawing room at a range of 10 miles, the loud-speaker used being the "Claritone Junior." Dull-emitter valves are used and provision is made for plugging in headphones if required. The earth and aerial terminals are at the back of the instrument and no loose wires or unsightly accessories are visible. The dimensions of the set are 19 x 12 x 9½ in. and its weight 28 lb.

E

A Chinese Electric Motor Carriage.

Possibly with the object of providing an automobile substitute for the popular jinricksha, the CHINA STORAGE BATTERY MANUFACTURING CO., of Shanghai, has recently introduced a two-seated electric motor carriage, which was recently depicted in the *Asiatic Motor*. The vehicle, in which the seats for the driver and passenger are ranged one behind the other, is provided with a 120-amp.-hour battery, which furnishes current for a special series-wound electric motor connected with the off-side rear wheel by means of a roller chain. The motor, which is rated at 30 amp. at 36 volts, is able to drive the vehicle at speeds ranging from 9 to 18 miles per hour. The controller is of a simple drum type, giving two forward speeds and a reverse position. The 26-in. diameter wire road wheels are shod with 3-in. pneumatic tires. It is stated that already half a dozen of the new vehicles, which are known as the "Hukuokuon," have been constructed and are in service in the Shanghai district.

The "Electric Perfection" Oven.

A cooker of simple and cheap construction has been placed on the market recently by MESSRS. COLEY & SWINNERTON, LTD., Bon Accord Works, St. John's Square, Wolverhampton. This appliance, the "Electric Perfection," is illustrated in fig. 4. In its simplest form the cooker consists of an oven measuring 19½ in. by 15½ in. by 15½ in. (exterior dimensions), mounted on legs 10½ in. high. The weight is only 47 lb.,

Fig. 4.—The "Electric Perfection" Oven.

and the total loading is 1 kW arranged in three "heats," the medium and low "heats" being .5 and .25 kW respectively. The working temperature range is between 290 and 345 deg. F., and a thermometer reading up to 500 deg. F. is fitted. One, two, three, or four boiling rings can be fitted, and the cooker is produced in three finishes.

Hand-operated Mica Undercutter.

A simple tool for undercutting the mica of commutators has been developed by MESSRS. PAPE & BENNISON, 23, Stanley Road, Barrow-in-Furness. The tool, which is illustrated in fig. 5 comprises a handle in which are fixed a wheel and a cutting blade. The blade is grooved and is tightened to the

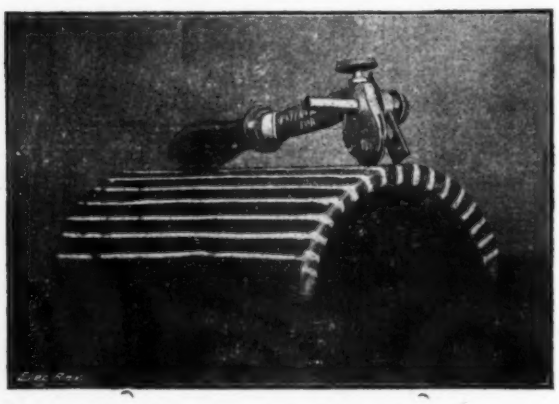

Fig. 5.—Hand-Operated Mica Undercutter.

spindle by means of a cheese-headed screw, being adjustable as to depth. The wheel and blade can be brought together or separated to correspond with the pitch of the commutator segments, so that the wheel acts as a guide to the blade.

The National Register of Electrical Installation Contractors.

Rules and Conditions of Registration.

THE National Register of Electrical Installation Contractors has become a corporate body and a booklet has been issued setting forth the conditions under which a contractor may become a member and enjoy the rights and privileges attaching to membership.

The members of the Council or Registration Board are as follows, the bodies by which they were nominated being given:—

Institution of Electrical Engineers.—Messrs. P. V. Hunter, C.B.E., W. R. Rawlings, W. M. Selvey, and C. H. Wordingham, C.B.E.

Incorporated Municipal Electrical Association.—Messrs. S. E. Britton, E. Calvert, and F. W. Purse, and Lt.-Col. W. A. Vignoles.

Electrical Contractors' Association.—Messrs. H. J. Cash, W. Cross, W. A. Shaw, and W. H. Walton.

Electrical Contractors' Association of Scotland.—Messrs. A. Lindsay, D. S. Munro, and A. B. Robertson, Junr.

British Electrical and Allied Manufacturers' Association.—Messrs. A. E. Iliffe and H. W. Roberts.

Association of Consulting Engineers.—Messrs. H. R. J. Burstall and A. H. Dykes.

Electrical Wholesalers' Federation.—Messrs. W. Harrison and P. M. Millns.

Royal Institute of British Architects.—Messrs. Max Clarke and A. E. Munby.

Irish Centre of the I.E.E.—Messrs. A. G. Bruty and F. G. Sherwood.

The secretary is Mr. T. Trimnell, 1, Lincoln's Inn Fields, W.C.2.

Applicants for registration must complete a form which has been approved by the Board, and a fee, which is returnable if the application is refused, must accompany the form. Upon acceptance of the application the new member must sign an undertaking to abide by the rules and conditions of the Register. He will not be required to conform to variations in the rules until the time comes for the renewal of his certificate.

Applicants must be in possession of the necessary equipment for the carrying on of the business of an electrical contractor; must be actually engaged in such business; and must either have been in business as a contractor for five years, have acted as charge hands on installation work for a competent firm or firms of contractors for five years, have passed the final examination of the City and Guilds of London Institute for electrical installation work, or other equivalent examination approved by the Board, or produce satisfactory evidence that they have had such theoretical and practical training as makes them competent to undertake installation work.

Companies, firms, and electricity supply undertakings will be eligible for membership if they comply with the conditions and employ a manager who also complies with the conditions, provided that the manager's name is included in registration. If the manager ceases to occupy that position the certificate will be automatically cancelled, but it will be renewed upon the appointment of another approved qualified person. This applies to companies and firms, not mainly electrical, who maintain an electrical installation department.

Temporary registration will be granted to applicants who are not actually in business as contractors, but registration will become null and void if business is not commenced within, at the most, three months. The Board may require applicants to produce evidence of their possession of suitable business premises and financial stability.

Registered contractors will be entitled to use the words "Registered by/under the National Register of Electrical Installation Contractors," "National Registered Electrical Contractor," or the letters "N.R.E.I.C.," and also to use the standard mark or device of the National Register. All certificates will cease to be valid after April 30th in each year, and will be returned at the date of expiry, and renewal will be made subject to the conditions on May 1st in each year. The fee for registration will be £5, and the annual renewal fee £1 paid in advance. Additional certificates will be issued at a charge of 5s. each. In the case of registration late in the year, the Executive Committee may in its discretion waive the first renewal fee.

Every registered contractor must at all reasonable times produce his certificate to any authorised representative of the National Register.

The Registration Board has power to revoke or cancel the certificate of any contractor who fails to comply with the rules and conditions, or for any of the following reasons:—If it be proved that he has wilfully misrepresented facts in his application; if he has created a risk to life or limb or serious fire hazard through the use of faulty or improper materials or by bad workmanship; if his standard of work is below the average of standard good workmanship, or otherwise not in accordance with the requirements of the

authority; if he does anything contrary to the integrity of the trade or injurious to the public; if he becomes bankrupt, makes an assignment for the benefit of creditors, or, in the case of a company, if it be wound up or a resolution be passed for winding-up, or upon change of ownership; in the event of the leaving of a manager (as mentioned previously); or if the holder refuses to permit inspection of his work by the Executive Committee, or its representatives, when complaints of improper workmanship, &c., have been made.

Any applicant or registered contractor may appeal to the Registration Board against a decision of the Executive Committee refusing or revoking or cancelling registration, within 28 days of the decision. A deposit representing the costs of the appeal must be made; this will be returned wholly or partly, or retained by the Board. Appeals will be heard by a meeting of the Board consisting of not less than five members, not members of the Executive Committee.

Cancelled or revoked certificates must be returned within one month after the contractor's name has been removed from the Register, and, pending its return, it must not be used for the purposes of the business. The contractor will not thereafter be permitted to use the terms of qualification which the certificate bestows.

The National Register may, at its discretion, publish or advertise the fact of the removal of a contractor's name from the Register.

The form of application contains a number of questions directed to elicit the *bona fides* and standing of applicants. The certificate is in simple terms, and bears the seal of the National Register.

Reviews.

The Electronic Theory of Valency. A general discussion held by the Faraday Society, July, 1923. Pp. 450-545. Aberdeen: The University Press, 1923. Price 10s. 6d.

The volume under review is a report of a discussion by the Faraday Society, and is one of a series which have been held at intervals during the last few years on various subjects. The present volume is divided into two parts; general and organic. The first section consists of opening remarks by the chairman, Sir J. J. Thomson, and addresses on "Valence and the Electron," by Prof. G. N. Lewis; "Bohr's Atom in Relation to the Problem of Covalency," by R. H. Fowler; "The Nature of the Non-Polar Link," by N. V. Sidgwick. The second section consists of opening remarks by the chairman, Sir Robert Robertson, and addresses on (1) "Application in Organic Chemistry of the Electronic Theory of Valency"; (2) "Intramolecular Ionisation in Organic Compounds"; and (3) "The Transmission of Chemical Affinity by Single Bonds," by Prof. T. M. Lowry; "Some Recent Contributions to the Theory of Induced Alternate Polarities in a Chain of Atoms," by Profs. A. Lapworth and R. Robinson; "Octet Stability in Relation to Orientation and Reactivity in Carbon Compounds," by Prof. R. Robinson; "Nuclear Tubes of Force and Bonds of Variable Polarity in an Atom," by Dr. H. Henstock; "Chemical Combination and Activation, and a Summary of the General Discussion," by Dr. E. K. Rideal.

Prof. G. N. Lewis attempts to co-relate conflicting opinions and reconcile the physicist's and chemist's views of the atom, and gives a general outline of the controversial points connected with the newer theories of valence in organic and inorganic chemistry. The points discussed are nomenclature, multiple bonds, tautomerism, conjugation and polarisation. Reference is made to the conflict between the dualistic or electro-chemical theory and the theory of structural organic chemistry, and the point is emphasised that in Prof. Lewis' opinion when the electron pair is situated between two atoms it is the agent of chemical union, and that the chemical bond is always such a pair of electrons. Prof. Fowler discusses the physical interpretation of covalency, distribution of electrons, the possibility of the existence of a quadruple bond, covalency, and electro-valency, the order of development of the different shells of electrons, and sextet electrons. Prof. Fowler states that the only ideal structure which might conceivably represent a molecule is an electron in the field of two equally-fixed positive nuclei, and suggests that the "sharing" of one electron confers structural instability. Prof. Sidgwick discusses the co-ordinate of the non-polar links, and makes a new assumption in connection with Bohr's theory of the atom. It is claimed that, together with the theory that the non-polar link consists in the "sharing" of two electrons between the two-linked atoms, the orbit of each "shared" electron includes both of the attached nuclei. Prof. Lowry, in his introductory remarks, advocates team work, consisting of chemists and physicists, to determine the electronic structure of molecules. In the first paper the theory of intramolecular ionisation is extended to organic compounds, the double bond being represented as made up of one covalency and one electro-valency. All chemical action is regarded as being ionic in character. The properties of "multipolar ions" furnish a basis for a novel theory of tautomeric ions. In the second paper types of valency are discussed, together with the transmission of chemical affinities. The author concludes that alternate polarities are characteristic of conjugated systems, and are not developed in chains of single bonds, where both acylous and basylous groups produce effects of constant sign. Profs. Lapworth's and Robinson's contributions consist principally of a criticism of Lowry's suggestion on "Induced Alternate Polarities"; they claimed prior postulation of "graded electro-valencies appearing in activated molecules." Prof. Robinson's paper consists of an explanation of the theory of "alternating polar effect" advanced in a recent publication by Kermack and Robinson, which appeared in *Trans.*, Chem. Soc., 1922, Vol. 121, p. 427. Dr. Henstock puts forward the view that it is not necessary that an electron should revolve round two nuclei in an elipse, but they may have a motion where they would cut the lines of force, at the corners of the octet where the bond occurs, twice at each complete revolution. Dr. Rideal is of opinion that the change in the polarity of a molecule must be ascribed to a change in the orbits of the covalent electrons, and proceeds in progressive quantumised steps in the final disintegration of the molecule into ions, atoms, or radicles.

Valuable contributions were made during the discussion by Sir William Bragg, Prof. J. F. Thorpe, Prof. W. A. Noyes, Dr. B. Flürscheim, and others. At the request of the Council of the Faraday Society, Dr. E. K. Rideal has prepared an admirable summary of the general discussion, which appears at the end of the volume.

Reports of discussions such as those held by the Faraday Society supply a demand for concise literature, giving the current views of authorities on the various subjects. A study of the volume under review shows a remarkable unanimity of opinion on a number of the points discussed from various standpoints, and gives authoritative views on the present position of electronic theories.

There is but one criticism to offer. The matter contained in this report of the discussion on the electronic theory of valency should be read by all students of chemistry and physics who desire to acquainted with the modern views on the subject, but its somewhat high price may mitigate against its otherwise freer and wider circulation.

E. L.

The Home Constructor's Wireless Guide. By W. JAMES. Pp. xv+199; figs. 95. London: The Wireless Press, Ltd. Price 3s. 6d. net.

The scope of this book is aptly described by its title. It is essentially a guide, not a text book nor a popular treatise, for the amateur experimenter who wishes to construct receiving sets in an intelligent manner. If he does not obtain satisfactory results, he has only to study the advice given, and act on it. It is pleasing to find the first few lines of the book recommending a single-wire aerial for ordinary broadcast reception, first, because the advice is sound, and, secondly, because it may help to clear away some of the multiple monstrosities which disfigure the landscape, but it is unfortunate that the misprint "*inverted* T-type aerial" on page 6, which might puzzle a beginner, escaped detection. As a matter of fact, however, the book is not suitable for a novice, as to properly understand it (as Mr. James would say) the reader must have some knowledge of the fundamental principles of the subject.

Mr. James, as supervisor to "Questions and Answers" in the *Wireless World*, has a unique experience of the difficulties met with by amateur experimenters, and makes full use of it in giving just the sort of information required in a palatable form. He deals with the construction, assembling, and adjustment of crystal and valve receivers, suitable for broadcast reception, and is right up to date with descriptions of the latest circuits and "dull emitter" valves.

An Introduction to the Study of Alternating Currents. By A. CLAYTON, D.Sc., A.M.I.E.E., Lecturer in Electrical Engineering at the Victoria University, Manchester. Pp. vii+296; figs. 253. London: Longmans, Green and Co. Price: 10s. 6d. net.

The purpose of the author has been to produce a text book on general alternating-current engineering suitable for use by students in universities and technical schools who are commencing the study of the subject, and the ground covered is more than would usually be attempted in one year though perhaps not sufficient, either in breadth or detail, for a course extending over two sessions.

A considerable part of the volume is devoted to the principles underlying current flow in single and polyphase circuits, which are treated in great detail. In particular the author may be commended for dealing with the effects of wave forms other than sinusoidal at much greater length than is usual in books of this class, and the subject of inductance is also very carefully and completely discussed. In connection with machine work we find that static transformers, alternators, synchronous motors and polyphase induction motors are described, though there is a rather noteworthy omission of any work concerning converting plant. Special chapters are concerned with the derivation of locus diagrams for alternating-current circuits and with the application of the method of complex quantities to alternating-current problems.

The introduction of a chapter on the last-named subject is,

we think, a thoroughly sound innovation in a book of an introductory nature; it is a method that is not well known to students in this country, but it is not difficult to understand, and certainly simplifies the working out of any example or application dealing with arrangements of impedances which are not of the simplest kind. It is true that care is necessary in order to avoid numerical errors when applying the method to numerical examples, but we feel that the method only needs to be better known in order to be appreciated.

The book seems to be remarkably free from inaccuracies, and the clearness of the text may also be commended, though the matter in connection with the differential testing of transformers may cause some little trouble to readers. In this connection the author first describes the Sumpner method with the help of a diagram, from which it is clear that the sum of the wattmeter readings will (neglecting the effect of instrument losses) be needed to obtain the losses in the transformers. He then describes his modified method, but omits to state in the text that the transformer losses are now given by the difference of the wattmeter readings; an important point of this nature is certainly worthy of explicit mention. Incidentally we note in connection with this matter that the number of the page to which reference is made in the second foot-note on page 168 is erroneously stated.

In one or two cases the labelling of the axes of the curves is open to objection. In order to fully label an axis both the name of the quantity and the name of the unit should be given, though where the curve is only intended to illustrate a point in a general manner the name of the unit may perhaps be omitted. In some cases in the book we find that an axis is only labelled with the name of the unit, and this may perhaps act as a bad example to readers.

The book concludes with a number of examples (provided with answers) which the author states, perhaps with unintended sarcasm, have been chosen for their educational value and are not to be looked on as a collection taken from examination papers.

The book may be recommended with confidence to students in our schools and also to engineers who wish to obtain exact ideas concerning the appliances and circuits with which they come into contact.

Atoms and Electrons. By J. W. N. SULLIVAN. Pp. 188. London: Hodder & Stoughton, Ltd.; price 2s. 6d. net.

This book has been written by the scientific editor of the *Nation*, with the object of satisfying the ever-increasing desire for knowledge concerning the revolutionary ideas about the constitution of matter which have been gaining currency of late years. The book is one of a series which aims at "learning without tears," and the chief difficulty of the author must have been to decide how much knowledge he might assume that his readers already possessed. The first chapter is devoted to units and dimensions and assumes very little; then, atoms and molecules, constituents of the atom, structure of the atom, the quantum theory, the grouping of atoms, and their inner structure, are treated in turn; and as the book goes on, a great deal more knowledge has to be assumed. Probably the man to whom the book will prove of most use will be one engaged in some application of science to industry, or one interested in science for its own sake, who in course of the last twenty years has seen various articles and attended occasional lectures upon the several fields in which advance was being made, and now desires to co-ordinate the information he has acquired thus piecemeal. There must be large numbers of people to whom it will prove extremely useful.

Wireless for the Amateur. By J. ROUSSEL. Pp. xiii+276; figs. 216. London: Constable & Co., Ltd. Price 14s. net.

This is a translation by Mr. H. G. Grylls of a French book by Monsieur J. Roussel, a prominent French amateur wireless experimenter, who has written it, as explained in its title, for amateurs.

Mr. Grylls keeps in mind throughout the requirements of the British amateur, and adds two chapters which apply specially to the conditions in this country, one on short-wave amplifiers, the other on short-wave transmission.

The book, the translator considers, "combines a reasonable amount of theory with definite constructional details, sufficient to enable the beginner or the more advanced amateur to construct for himself and understand the working of any particular receiving set."

We do not question its use to an advanced amateur, but we consider that its general arrangement and mass of detail would prove bewildering to a beginner. The latter should be introduced to fundamental principles, and led on to details step by step, but this book is not arranged on such lines. The former knows how to find what he wants and will succeed in doing so here, though his search would be shortened by a better index.

Monsieur Roussel has collected together a great mass of information, mostly on constructional detail, which should be of great value to the experienced amateur even if he possess very little mathematical knowledge, and the two chapters by Mr. Grylls effectually bridge the gap between the requirements of the French and British experimenters.

Business Notes.

Bankruptcy Proceedings.—C. WRIGHT and H. T. WRIGHT, electrical engineers, 251, Fulham Road, Chelsea, S.W.—Last day for proofs for dividend, February 15th. Trustee, Mr. W. Strachan, 50, Gresham Street, E.C.

C. WRIGHT (separate estate).—Last day for proofs for dividend, February 15th. Trustee, Mr. W. Strachan, 50, Gresham Street, E.C.

H. T. WRIGHT (separate estate).—Last day for proofs for dividend, February 15th. Trustee, Mr. W. Strachan, 50, Gresham Street, E.C.

GEORGE ALBERT MORLEY, 201, Powis Street, Woolwich, electrician and wireless engineer.—The receiving order in this matter was made on January 5th, on debtor's own petition. The statement of affairs showed liabilities of £787, and the assets, after deducting preferential claims, are estimated at £258. Debtor attributes his failure to loss incurred in the purchase of a patent wireless receiving set, expenses of opening two branch establishments which proved failures, cost of experiments with wireless accessories, general trade depression since March, 1923, interest on loans and law costs. It appeared that he commenced business in April, 1921, at the above address, under the style of A. Whale & Co., with £40 capital, and stock estimated at £100, supplied by a friend on "sale or return." From July, 1922, to April, 1923, he rented an office and showroom at 321, Vauxhall Bridge Road, and endeavoured to work up a London connection, but without success. On March 5th he entered into an agreement to purchase for £300 the patent rights of a wireless receiving set; he paid £74 on account, but failed to pay the balance, and on October 4th, 1923, the vendor obtained judgment against him for £226 and costs. From May to July, 1923, he rented an office at 124, Victoria Street, S.W. for the purpose of dealing wholesale in wireless and electrical accessories, but that business was not a success, and he lost about £30. Since May, 1923, he had expended about £100 in wireless experimental work, and patent fees, &c., and he had had recourse to moneylenders for loans amounting to £140. Debtor admitted having been aware of his position since October, 1923. The following are creditors:—

	£		£
British Broadcasting Co. ...	42	W. Gammons	23
H. Bowen	108	A. Hardy	100
H. Bennett	60	H. Knight	35
B. G. Calver	178	H. Ruffells	34
Ever-Ready Co.	12	Siemens Bros. & Co., Ltd. ...	35
J. Gee	60		

ALBAN JOSEPH ROBERTS, electrical engineer, 10, Ormond Mansions, Southampton Row, London, W.C.—This debtor attended on January 29th, before Mr. Registrar Mellor, at the London Bankruptcy Court, for public examination upon accounts showing liabilities £526, and assets valued at £1,014, and consisting of patent rights and royalties. In reply to Mr. Armstrong, Official Receiver, the debtor stated that he started business as an electrical engineer in New Zealand during 1906, with a capital of £500. Two years later he was sent to London by the Australian Government for the purpose of demonstrating a wireless torpedo which he had invented. From 1911 to 1914 he exhibited a wireless airship at various music-halls in this country and abroad, receiving about £80 a week for so doing. He was in Australia in 1914, but then gave up the music-hall exhibition work and commenced to build an airship with the object of flying to New Guinea. In 1915 he joined H.M. Forces, and upon demobilisation, in April, 1919, he received a gratuity of £200. During the next 18 months he was engaged at various theatres in giving an electrical performance, at a salary of about £90 a week. In June, 1922, he took premises at 6, Regent Square, W., for the purpose of manufacturing certain "sound controlled" toys of which he was the inventor. The principal toy was a dog in a kennel. The dog came out when called by name—it was controlled by a sound-box, to which was attached a kicker-plate, and when the name was called the vibration of the kicker-plate forced the dog out of the kennel. Having experienced difficulty in obtaining toy dogs necessary for the toy, witness arranged with a doll manufacturer to supply 3,750 of these dogs by August, 1922. The manufacturer failed to supply any of the consignment to date, and afterwards only about 800 out of the total of 3,750, and these were not up to sample.

As a consequence witness was unable to complete his contracts, and in January, 1923, had to close his business, the loss on the venture amounting to about £1,200. Since then he had been carrying out contracts to supply lighting effects at various theatres. The examination was concluded.

GEORGE WILLIAM ROBINSON, 76, Cemetery Road, Porth, Glam., electrical engineer and dealer in wireless instruments, &c.—The public examination of this debtor was held on January 29th, at the Court House, Court House Street, Pontypridd. The statement of affairs showed liabilities of £233, against assets of £11, or a deficiency of £222. Debtor attributed his failure to lack of capital and bad trade. It appeared that in March, 1922, he started business as an electrical engineer, with £35 capital, of which £5 represented his savings. His business consisted chiefly of dealings in wireless instruments and accessories. He had never taken stock, neither had he kept proper books of account. The examination was closed.

STANLEY SIDWELL, 51, Islington Row, Birmingham, electrical engineer.—The public examination of this debtor was held on January 30th, at the Court House, Corporation Street, Birmingham. The statement of affairs disclosed a deficiency of £307. It appeared that debtor commenced business on his own account in March, 1922, with a capital of £60, £40 representing his Army gratuity. He had previously worked as a journeyman, but had to give up owing to lack of trade. The capital was insufficient from the start, and in April he borrowed £60 on the security of a life insurance policy for £150, and in the following October another £40 from the same person. The examination was adjourned for the signing of the notes.

T. CARTER, electrical engineer, 16, Dumgate Street, Dorchester.—Last day for proofs for dividend, February 14th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

HAROLD WILLIAM SLATER, described in the receiving order as The Engineering Supplies Co., 34, Grey Street, Newcastle-on-Tyne, mechanical and electrical engineer.—The first meeting of the creditors of the above was held on January 29th, at the Official Receiver's Office, 4, Northumberland Street, Newcastle-on-Tyne. According to the statement of affairs, there were liabilities amounting to £19,795, and assets of only 19s. 10d. Debtor attributed his failure to losing a case for breach of contract, which meant a loss of £17,000. The case being a summary one, was left in the hands of the Official Receiver as trustee.

A. WILSON, electrician, Market Place, Howden, Yorks.—Last day for proofs for dividend, February 13th. Trustee, Mr. J. E. D. Strikney, O.R., 36, Scale Lane, Hull.

Company Liquidations.—H. HAYDON & Co., LTD.—Meeting of creditors, February 11th, at the offices of Messrs. A. C. Palmer & Co., Court Chambers, Friars Lane, Leicester. Particulars of claims to the Liquidator, Mr. T. F. Birch, Court Chambers, Friars Lane, Leicester.

INDICATORS, LTD., 11, Southampton Row, London, W.C.—The statutory first meetings of the creditors and shareholders of this company, which was formed in May, 1919, for the purpose of acquiring patent rights and other interests relating to electrical advertising appliances, were held on January 30th, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Mr. J. Barwick Thompson, Official Receiver, reported that the winding-up order was made on November 27th, upon the petition of Johnson & Phillips, Ltd.

The company was registered as a private company, and the persons mainly interested in its formation were Paul Henry Waller and Bernard Emanuel Nordman. The nominal capital was originally £24,000, divided into 22,500 cumulative preference shares of £1 each and 30,000 ordinary shares of 1s. each. This was afterwards increased to £35,000 by the creation of 11,000 additional preference shares, and in October, 1922, the capital was again increased, on this occasion to £70,000, the company having in the previous October been converted into a public company. Of the nominal capital, 39,119 preference and 48,542 ordinary shares had been issued, of which 29,619 preference and 18,542 ordinary were issued for cash, while the others were issued as fully paid in compliance with the terms of certain agreements. One of these agreements was entered into in September, 1919, and it provided for the purchase by the company from Waller and Nordman of four patents relating to station or stopping indicators for public vehicles and apparatus for exhibiting notices and the like. All the machines were automatic in action and electrically controlled. From the beginning the company found itself short of working capital, and from time to time efforts were made to obtain money on security of debentures, but without success, and negotiations for the sale of the foreign patents fell through, with the result that the company was left without resources early last year. Since May last the business of the company had been confined to maintaining the indicators on the Metropolitan Railway and to selling a limited number of localisers. The failure of the company was attributed to lack of working capital throughout its existence and lack of success attending a scheme of reconstruction. In the opinion of the Official Receiver the failure was largely due to the fact that too much work and responsibility was thrown on the managing director, whose special sphere lay in the technical side of the business, and not in the financial. Since the liquidation, Waller had been trying to interest persons in a possible reconstruction of the company. According to the statement of the company's affairs, the liabilities amounted to £13,854, of which £8,074 was expected to rank, while the assets were estimated to realise £6,142. The latter consisted as to £5,147 of the estimated surplus to come from securities held by creditors regarded as fully secured. After payment of preferential claims amounting £914, a deficiency of £2,846 was shown with reference to the creditors, while in relation to the shareholders a total deficiency of £44,392 was disclosed. A resolution was passed for Mr. R. G. Pye (E. S. Havard Pye & Co.), 26, Budge Row, E.C., to act as liquidator.

Appended is a list of the principal creditors:—

	£
Unsecured—	
Avenue Press	24
Boult, Wade & Tennant ...	68
E. Camelinat & Co., Ltd. ...	31
Electric Railway and Tramway Co., Ltd.	60
Fortis & Partners	45
Franco-British Electrical Co., Ltd.	45
Hudson & Kearns, Ltd.	32
Hyde & Hyde	16
Igranic Electric Co., Ltd. ...	82
Johnson & Phillips, Ltd. ...	664
Geo. H. Neal & Co., Ltd. ...	248
J. P. O'Donnell & Co.	189
Park Royal Engineering Works, Ltd.	141
Thos. Phelps	272
A. & H. Rowley	58
St. Clement's Press, Ltd. ...	219
W. H. Smith & Son	400
Synergy (Gt. Britain) Co., Ltd.	71
Wigan Corporation	414
W. C. Thorn, Ltd.	28
Fully secured	4,852
Preferential	914

BRITISH INDUSTRIES FAIR, BIRMINGHAM (INCORP.).—A meeting of members is called for March 3rd, at the Chamber of Commerce, 95, New Street, Birmingham, to hear an account of the winding-up from the Liquidator, Mr. G. H. Wright.

ARMATURE REPAIRING & SUPPLY CO., LTD.—A meeting of members is called for March 1st, at Bank Buildings, Temple Street, Swansea, to hear an account of the winding-up from the Liquidator, Mr. A. O. John.

Dissolution of Partnership.—HOWLETT & RYAN, electrical engineers, 14-16, Victoria Street, Windsor. Messrs. C. R. B. Howlett and L. R. Ryan have dissolved partnership. Mr. Howlett will attend to debts, and continue the business under the same style.

Trade Announcements.—In order to cope with growing business, Messrs. TWISS ELECTRIC TRANSMISSION, LTD., have opened a branch office at 24, Pearl Buildings, Newcastle-upon-Tyne, under Mr. G. P. Hawkins, who represents the company in Northumberland, Cumberland, Westmorland, and the northern part of Lancashire and Yorkshire. Mr. J. E. Storr is in charge of the office at 13, Bond Street, Leeds, and looks after an area covering the southern parts of Lancashire and Yorkshire, the northern part of Derbyshire, and the counties of Lincoln and Nottingham.

Messrs. MANN, EGERTON & Co., LTD., announce that their address is now: Electrical Department, Major's Corner, Ipswich.

Mr. P. FITZGERALD, of 16, East Beach, Cobh (Queenstown), desires to receive catalogues, &c., of wireless sets and accessories.

Mr. E. W. BOND has purchased the business of Mr. J. Fordham, ironmonger, of 1, Bridge Street, Dover, and is transferring his electrical contracting business to that address. Catalogues, &c., of electrical accessories, wireless sets and parts, are asked for.

Mr. ALLAN LESLIE has opened a showroom and stores at 192, Buchanan Street, Glasgow, for trade business in electrical and wireless wholesale supplies. Until the end of 1923 he was sales manager at Glasgow for the Associated Electric Co. Manufacturers' lists are wanted.

MESSRS. WM. SANDERS & Co., of Falcon Electrical Works, Wednesbury, ask us to state that the official return relating to W. Sanders & Co. (1915), Ltd., appearing in our issue of January 25th, 1924, p. 146, does not refer to them. Wm. Sanders & Co. is a private business; Mr. Wm. Preston is its sole proprietor; and the firm has no connection with the limited company mentioned.

THE ELECTRICAL APPARATUS CO., LTD., has arranged an exhibition of its control gear at Touchbutton House (Messrs. Berry's Electric Co., Ltd.), 5, Deansgate, Manchester. It will remain open until March 1st.

MESSRS. WATLIFF & Co., commutator engineers, have acquired additional premises, and all correspondence should be addressed to 87, Cambridge Road, Kilburn, London, N.W.6.

MESSRS. CHELLIS, LTD., have opened showrooms at 257, High Holborn, London, W.C., for electrical and wireless apparatus. Catalogues, &c., are wanted.

For Sale.—By order of the Postmaster-General, the Controller, Post Office Stores Department, invites offers for plant (boilers, electric motors, &c.) lying at the Head Post Office, Liverpool. Messrs. Toplis & Harding will offer for sale by auction on February 13th, at 137, Cheapside, 2,000 "Condor" electric lamps, 200 to 240 V. (See our advertisement pages to-day.)

Calendars and Diaries.—MESSRS. ANDERSON, BOYES & Co., LTD., have sent us a wall calendar with monthly slips, bearing illustrations of their coal-cutters, and a "Cutter at Sea."

From the MACINTOSH CABLE CO., LTD., we have received a memoranda pad of convenient size with a calendar for 1924.

A wall-sheet calendar bearing illustrations of the company's well-boring equipment, &c., and monthly date slips has been received from Messrs. C. ISLER & Co., LTD.

Stoker Contracts.—Among the contracts recently booked by the UNDERFEED STOKER CO., LTD., is one for eight travelling grate stokers for the Great Western Railway; also one for nine for Japan. Ash and coal-conveying equipment is being supplied to the Folkestone electricity supply undertaking.

Catalogues and Lists.—MESSRS. ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10.—Leaflet L, containing illustrated descriptions of current-limiting apparatus. The publication also gives examples of special tariffs for electricity supplied through limiters, and gives particulars of results.

THE HORSTMANN GEAR CO., LTD., Newbridge Works, Bath.—A pamphlet dealing with the automatic control of lighting (especially for streets and shop windows) by time switches.

MESSRS. C. ISLER & CO., LTD., Artesian Works, Bear Lane, Southwark, S.E.—A well-illustrated pamphlet describing artesian well-boring equipment.

MESSRS. WILLIAM ALLAN & CO., 62, Dale Street, Liverpool.—A priced and illustrated folder describing a new type of adjustable plugs and sockets.

MESSRS. JOHN T. HARDAKER, LTD., Bowling Iron Works, Bradford.—An illustrated sheet advertising lifting trucks, elevators, and other goods-handling equipment.

MESSRS. REAVELL & CO., LTD., Ranelagh Works, Ipswich.—Pamphlet No. 113, describing and illustrating portable air-compressing sets for road-breaking and other purposes.

MESSRS. HENRY JOSEPH & CO., LTD., 96, Victoria Street, S.W.1.—A price list of accessories for radio-telephony receiving installations.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Leaflet 77b, describing "Radiomatic" valve receiving sets; and Leaflet 95, dealing with the "Tangent" loud speaker. Both publications are illustrated and priced.

THE FOSTER ENGINEERING CO., LTD., Morden Works, Wimbledon, S.W.19.—A new price list of ironclad switch- and fuse-gear of many types. Also a blotter advertising industrial lighting fittings.

MESSRS. COLEY & SWINNERTON, LTD., Bon Accord Works, St. John's Square, Wolverhampton.—An illustrated pamphlet containing particulars of the "Electric Perfection" oven.

MESSRS. ENGINEERING SUPPLIES, LTD., 155a, Upper Thames Street, E.C.4.—An illustrated and priced catalogue of components of radio sets.

New G.E.C. Sign.—In Leicester Square, which is fast becoming a rival to Piccadilly Circus in the matter of electric signs, the GENERAL ELECTRIC CO., LTD., has recently erected a sign advertising "Osram" gas-filled lamps. The structure comprises about 1,500 lamps in five colours.

Social Events.—At the Queen's Hotel, Birmingham, recently, the members of the staff of the Birmingham and Midland Joint Committee of Electricity, Tramway and Omnibus Undertakings held their annual dinner, Mr. J. T. H. Legge, of the Shropshire, Worcestershire, and Staffordshire Electric Power Company, taking the chair. Mr. W. G. Bond, managing director, proposed the toast of the Joint Committee, which was responded to by Mr. R. Humphries, on behalf of the staff of the tramways of the Black Country, Mr. J. T. H. Legge, on behalf on the staff of the Shropshire, Worcestershire and Staffordshire Electric Power Co., and Mr. Power, on behalf of the staff of the Midland "Red" Omnibus Co. A number of items were contributed by some well known artistes.

On February 1st the staff of Messrs. Siemens & English Electric Lamp Co., Ltd., held a social evening. The main item was the performance of a revue, "Yes, We Have No ——?" by members of the staff, whose proper names were concealed beneath expressive pseudonyms. A whist drive and dance followed the revue, and wound up a very pleasant evening.

Swiss National Radio Exhibition.—An exhibition of radio apparatus will be held at Geneva between May 21st and June 1st and will comprise twelve groups of exhibits of apparatus and machinery used in its production. One group will contain statistical and instructional information, including the results of exploitation, patents and inventions, apparatus for instruction, diagrams, tables, models, plans, projects, &c., besides periodicals and literature on the subject.

It is expected that much interest will be displayed in the Exhibition as showing the development reached in Switzerland in the production of all the equipment connected with radio transmission.—*Reuter* (Geneva).

Rumanian Export Duties Modified.—Modifications in certain export duties were announced by the Rumanian authorities on January 10th. Among these is the adjustment of the duty on "Galvanic elements and batteries for electric lamps" to 5 lei per 100 kg.

The Electrical Federation of Victoria.—The annual meeting of the Electrical Federation (Victoria) was held in Melbourne in December. Mr. E. M. Ritchie, the president, in the course of an address, referred to the question of licensing. In Victoria, he said, the employés and electricians themselves were licensed, and no responsibility rested on the contractors. On the other hand, in New South Wales the contractors were licensed. South Australia was introducing licensing legislation, while Western Australia had other methods of dealing with the matter. These differences of method in the States emphasised the need for the consideration of problems on a Federal basis. A lead had already been given by the employés, who were seeking to obtain uniform working conditions throughout the Commonwealth. Mr. Ritchie suggested that the time was ripe for co-operation between the associations of the various States. The questions which needed attention included standardisation of materials, conditions, costing, &c.; propaganda; research and experimental work; inter-trade relations; and legislation. The meeting passed a resolution agreeing to call a meeting of representatives of the various associations. Mr. L. G. Hindwood was elected president for the current year.

Electricians' Wages.—The District Industrial Council for the Electricity Supply Industry, West Midland Area, stated, in a circular issued last week, that in accordance with notice from the National Council it has been decided that for the purpose of ascertaining adjustments of wages under the sliding scale clause all future calculations shall be made from the original datum line of 120 per cent. Adjustments will be determined by the number of complete variations of six points from 120 points each quarter. The index figure for October, November, and December showed an average of 75¾ above the figure for August, 1914, which, if deducted from the datum line of 120, gives a fall of 44¼ points, or seven complete variations of six points—3½d. per hour total reduction under the National Agreement of November, 1921, whereas the total reduction at present amounts to 4d. per hour. There will, therefore, be an increase of one halfpenny per hour in the rates of wages as from January 1st this year. There will also be an increase from the same date in the pay of youths and apprentices employed by constituent undertakings as follows:—9d. per week in the case of boys of 16 and 17 years of age, and 1s. 4d. per week in the case of youths of from 18 to 20 years of age, inclusive.

The British Industries Fair.—By a special arrangement between the railway groups and the Department of Overseas Trade (the organisers of the Fair), visitors will be able to make the return journey from anywhere in Great Britain at a cost of one and a third of the ordinary single fare. Attached to each of the invitations issued by the Department of Overseas Trade to trade buyers will be a special slip which the visitor to the Fair can present at the railway booking office when he purchases his ticket for either London or Birmingham. On it the booking clerk will stamp the name of the station from which the visitor to the Fair is travelling. The visitor, when at the Fair, has then only to have the stamp of the Fair authorities affixed, and the slip at once becomes a voucher which will be accepted at the railway stations in both London and Birmingham as worth two-thirds of his return fare to the station from which he started. The saving to buyers who come from long distances will be considerable. A buyer, for example, whose single fare to London is £3 will be able to purchase a ticket for his return journey for £1 on handing his stamped voucher to the booking clerk at his London station. Such action by the railway companies is a striking pronouncement of their belief in the Fair as an important factor in the creation of national wealth, and should play a considerable part in augmenting the volume of business done.

New Zealand Electrical Imports.—There was an improvement last year in the importation of electrical machinery and equipment into New Zealand, the returns for the ten months ended with October last showing a total of £1,168,851, as compared with only £803,630 in the corresponding period of 1922.

New French Companies.—There has been formed at at Cheylard (Ardèche) the Société Lozérienne d'Energie Electrique, with a capital of 1,500,000 fr., for the distribution of current, chiefly at Mende, in the department of Ardèche. For the manufacture of and trade in electrical material, the Société Française d'Appareillage Electrique has been embodied, with a capital of 100,000 fr. Its offices are at Paris (3, Rue Davioud). For the distribution of electricity, chiefly in the departments of the Ain, Jura, Doubs, and Saône-et-Loire, La Bressanne Electrique Société Electrique has been constituted. Its capital is 500,000 fr., and its offices at 3, Rue Président Carnot, Lyons. The Société d'Electrification Rurale du Centre is a company formed to generate electricity for distribution in the rural districts of the centre of France. Its offices are at 18, Avenue Théodore de Banville, Moulins (Allier), and its capital 500,000 fr.

New Belgian Companies.—The Société pour l'Exploitation des Procédés thermiques, Systeme Puissand, has been formed at Brussels (5, Rue Van Orley) for the installation of electric lighting, motive power, and central heating, particularly on the above-named system. Its capital is 1,400,000 fr.

Lampe Nova is the style of a company embodied at Brussels (52, Rue Breydel) for the manufacture and sale of electric lamps and accessories. Its capital is 250,000 fr.

The Ateliers de Constructicn Electrique, "The Belgian Electrical Company," is the denomination of a company formed to take over the works and business of the electrical company named in its title. Its address is 129-131, Rue Sans Souci, Brussels.

The Société Anonyme "General Radio" has been established at Antwerp (14, Rampart Kepdorp), with a capital of 100,000 fr., to carry on trade in apparatus relating to telegraphy and wireless telephony. There has been formed at St. Gilles-lez-Bruxelles (54, Rue de la Croix de Pierre) the

Société Anonyme Electricité Olivier, for the carrying out of electrical installations, and the purchase and sale of electrical material for this purpose. The capital is 200,000 fr.

Electric Steel Production in Italy.—An Italian company has been formed under the title of the Cogne-Girod Electric Steel Works Company to take over the working of the electro-metallurgical establishments which were created by the Ansaldo Co. at Aosta at the close of the war. The plant comprises electric blast furnaces, works for the production of ferro-alloys, and an electric steel plant comprising four furnaces, each of 20 tons, and several small furnaces, the capacity of the steel works being 50,000 tons per annum. The basis of the whole works is the Cogne iron-ore mine, which is connected with the former by means of a line which is partly aerial and partly of narrow gauge, and yields ore having an iron content of 60 per cent. The new company has a share capital of 30,000,000 lire, which has been subscribed partly by the Ansaldo-Cogne Co. and a group of Swiss interests, headed by M. Paul Girod.

Trade Conditions in China.—A special correspondent in Tientsin, writing with regard to the best course to be followed by British manufacturers in opening trading relations in China, says:—"It seems to me that the manufacturer must follow the example of the agriculturist who first plants his seed, then nourishes it during the growing period, and afterwards receives the benefit of the harvest. The British manufacturer will have to plant, or co-operate with experienced engineers here, furnishing them with sufficient support during the spade-work period; and in due course he will reap a rich harvest. This is the trade policy the Americans and the Germans are pursuing, and I have reason to believe with good results."

The writer sends the following interesting table showing the extent of exchange variations in China, over a period of years, down to date:—

HAIKUAN TAEL EQUIVALENT.

		s. d.	£1 =	U.S.G. $
1922	August	2 4⅝	Tls. 7·55	0·64
	November	2 5⅝	7·33	0·66
1923	June	2 9	6·53	0·67
	December	2 10½	6·21	0·70⅛

(T.T.) TELEGRAPHIC TRANSFER. 5 YEARS BEFORE THE WAR PERIOD.

			s. d.
Pre-War	1909	Highest	2 5¾
		Lowest	2 3½
	1910	do.	2 6⅜
		do.	2 3½
	1911	do.	2 5⅝
		do.	2 4
	1912	do.	2 10 7/16
		do.	2 5 15/16
	1913	do.	2 10½
		do.	2 6⅜
War	1914	do.	2 7⅜
		do.	2 1⅝
	1915	do.	2 7⅜
		do.	2 2⅜
	1916	do.	3 6½
		do.	2 6⅜
	1917	do.	4 10½
		do.	3 3½
	1918	do.	5 7
		do.	4 2½
Post War	1919	Highest	7 1⅝
		Lowest	4 6
	1920	do.	9 3
		do.	3 11
	1921	do.	4 1½
		do.	2 11
	1922	do.	3 10
		do.	3 2
	16th December, 1923		3 6

AVERAGE T.T. RATE.

	s. d.
1913	2 8½
1914	2 5⅝
1915	2 3⅜
1916	2 11 1/16
1917	3 10⅜
1918	4 8 5/16
1919	5 7⅛
1920	6 1 7/16
1921	3 6⅜
1922	3 6

Unemployment.—There was a decrease of 4,540 in the number of persons registered as totally unemployed on January 21st as compared with the previous week, the total being 1,215,900. Short-time workers also decreased in number, there being 51,300 on January 21st, as compared with 52,824 a week earlier.

Book Notices.—"Kelly's Directory of the Electrical Industry, Wireless and Allied Trades, 1924." (Pp. xxix+1,037.) London: Kelly's Directories, Ltd. Price 30s. post free.—This new reference work comprises seven sections, *viz.*, a county list; big towns, presenting the names of electrical engineers and companies, particulars of population, &c.; a list of public electricity supply undertakings with details of systems and *personnel*; an alphabetical list of persons and firms engaged in the electrical industry in London; a classified list of these; similar lists for the rest of the United Kingdom and Ireland; and a list of proprietary articles and trade names. As perhaps might have been expected in a first edition, there are many notable omissions, particularly from the list of consulting engineers, and many names appear which might have been left out. The methods of classification leave something to be desired; for instance, only one firm, and that a Swiss one, appears under the heading "Central Station Switchgear and Switchboard Makers" in London, although, it is only fair to say, the rest appear in other sections. The list of provincial insulated wire manufacturers is far too short, and there are many important firms left out of other sections. The list of proprietary articles is swollen by repetition and superfluous entries, under which we class the reproduction of firms' names where these coincide with the trade descriptions of their products. So far as we have checked it, the list of electricity supply undertakings seems very complete and accurate, and, upon the whole, we suppose that the directory will be found useful by a large number of purchasers, although we hope that the second edition will be more complete and reliable—a huge task, but not outside the capabilities of the publishers.

"Fowler's Electrical Engineer's Pocket Book, 1924" (price 3s. net); "Fowler's Mechanical Engineer's Pocket Book, 1924 (3s. net);. and "Fowler's Mechanics' and Machinists' Pocket Book, 1924" (price 2s. net). Manchester: Scientific Publishing Co.—These compact pocket books, which are now in their 24th, 26th, and 16th editions respectively, have been revised where necessary and brought up to date, but the absence of prefaces makes the discovery of new matter very difficult.

"Hydro-electric Power Stations," by D. B. Rushmore and E. A. Lof. Second edition. Pp. viii+830; figs. 436. London: Chapman & Hall, Ltd. Price 37s. 6d. net.

"*Mechanical World* Electrical Pocket Book for 1924." London: Emmott & Co., Ltd. Price 1s. 6d. net.

"The *Transactions* of the South African Institute of Electrical Engineers." November, 1923. Johannesburg: The Institute. Price 2s. The papers reproduced in this issue are:—"The Testing of Turbo-generating and Turbo-compressing Plant," by W. H. Badger; and "Oscillograms," by E. M. Dall.

"Electricity Meter Practice." By H. G. Solomon. Pp. viii+189; figs. 58. London: C. Griffin & Co., Ltd. Price 7s. 6d. net.

"Rotary and other Converters." By W. S. Ibbetson. Pp. viii+164; figs. 50. London: E. & F. N. Spon, Ltd. Price 7s. 6d. net.

"La Télégraphie sans fil." By J. Verdier. Pp. viii+412, illustrated. Paris: Gauthier-Villars & Cie. Price 35 fr.

"Science Abstracts A and B." Vol. XXVII, No. 313, Part 1. January 25th, 1924; also Index to Vol. XXVI (A. and B.). London: E. & F. N. Spon, Ltd. Price 3s. each.

"Our Silent Partner—Electricity and its Usage in Modern Life." By A. Sullivan. London: British Electrical Development Association.

"South Wales Coal Buyer's Handbook." By W. Phillips. Cardiff, West Bute Street: The Author. Price 10s.

Recent Contracts.—THE CHLORIDE ELECTRICAL STORAGE CO., LTD., has recently received three important orders for batteries, *viz.*: Wolverhampton Corporation, 230 cells, with a capacity of 930 Ah at the 10-hour rate; Aldershot Gas and Electric Supply Co., Ltd., 90 cells, with a capacity of 600 Ah, installed in the gasworks to relieve the converting plant of the peaks occasioned by the motors driving coke breakers and conveyors; and the Charing Cross, West End and City Electric Supply Co., Ltd., 90 cells, with a capacity of 600 Ah, for the Stratford power station.

Among the more important orders received recently by MESSRS. TWISS ELECTRIC TRANSMISSION, LTD., are the following: Newcastle Electric Supply Co., double-circuit, 66,000-V, steel-tower line, ten miles long, and a similar line across the Tyne, with a span of 1,000 ft.; Yorkshire Electric Power Co., 12 miles of 11,000-V steel-tower, and four miles of h. and l.p. lines on wood poles; The Rhodesia Broken Hill Co., a 36-mile, 86,000-V line from the Mulungushi River Falls to the company's mining system; porcelain and hardware for the electrification of Nymboida and other townships in New South Wales; and the supply of all transmission line material, including lattice steel towers for the supply of power and light to the municipality of Valencia, Spain.

East African Conditions.—Colonel Franklin, H.M. Trade Commissioner in East Africa, says in a recent report that in spite of the appreciation of the dollar exchange the United Kingdom has secured an increased share in these territories of the trade in electrical goods and apparatus. Britain now virtually commands this market. He says that probably the reason is the failure of a large distributing house for American goods. The demand is likely to increase owing to the fact that the East African Power & Lighting Co. is now extending its plant, both at Mombasa and Nairobi, whilst further extensions are foreshadowed. With regard to general economic conditions, Colonel Franklin points out that the position, whilst not nearly so bright as was hoped, is more stable than for some time past. Exports are increasing and the political situation appears to have cleared. Although there may have been some over-ordering of staple lines in the recent past, crop prospects are bright and there is no real ground for alarm.

The following table shows the value of the market for electrical goods:—

TOTAL IMPORTS INTO KENYA.

	1922. £
Electric wires and cables, insulated.—	
Total	30,000
From United Kingdom	27,000
Other electrical goods and apparatus.—	
Total	8,000
From United Kingdom	7,000
Telegraph and telephone instruments and apparatus.—	
Total (all from U.K.)	6,000
Cranes, hoists and lifting machinery.—	
Total (nearly all from U.K.)	34,000
Electrical machinery and parts.—	
Total	4,000
From United Kingdom	2,400
,, Belgium	1,000
,, Sweden	600

New Italian Companies.—There has been formed at Rome the Società Idro-elettrica, Alto Savio, with a capital of 4,000,000 lire, for the harnessing of water power and the distribution of electric current. With a capital of 1,000,000 lire a company has been constituted at Sepino Terzo, entitled Società Industrie Elettriche Sepino. For the construction and working of wireless stations of medium and small power there has been formed at Milan the Società Radio Reale Italiana. Its capital is 10,000 lire.

Ediswan Contracts.—THE EDISWAN ELECTRIC CO., LTD., has received contracts as follows:—

G.P.O.—Resistance tablets.

Lamport & Holt.—Electrical lamps and material, six months' supplies.

Local Exhibitions.—BELFAST.—The electrical exhibition arranged by the Corporation which was held in the Ulster Hall, Belfast, last month, was a very comprehensive show and many English electrical firms took the opportunity of displaying their products. The British Thomson-Houston Co., Ltd., showed vacuum cleaners, standard lamps, percolators, &c. The Sun Electrical Co., Ltd., had as its principal exhibit the "A.B.C." washing machine as well as smaller appliances. Cookers, fires, and lighting fittings were included on the stand of the General Electric Co., Ltd. Several local firms of contractor-dealers exhibited, including Messrs. William Curran, Stanley Johnston, Ltd., McKeown & Morton, Ltd., Craig and Paton, Birch & Workman, Ltd., Gilmore & Co., and John M'Master & Sons.

BRADFORD.—The Corporation is at present holding a trades exhibition at the Belle Vue Barracks. An excellent electricity display has been arranged, and, in addition, the hall itself is heated by forty-six bowl fires.

Shop-window Lighting.—To demonstrate what shop-window lighting should be like the GENERAL ELECTRIC CO., LTD., has arranged at Magnet House a complete model shop window equipped with the latest lighting devices. Displays of all kinds are being arranged in this to suit various classes of goods.

The Scottish Motor Show.—There were many examples of the application of electricity to the modern motor car to be seen at the show of the Scottish Motor Trade Association, held recently in the Kelvin Hall, Glasgow. It is noteworthy that the British-made magneto was predominant. The exhibit of Exide batteries attracted much attention. Various examples of automobile electrical work were exhibited by Messrs. C. A. Vandervell & Co., Ltd.

Callender's Hospital Fund.—The statement of accounts of Callender's Hospital and Distress Fund for the year 1923 shows that after disbursing grants amounting to over £850 there remained a balance in hand of £92. There was a substantial increase in the total sum received from members' weekly subscriptions, and altogether the year was the most successful since the inauguration of the fund 21 years ago.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications, the name and addresses of the British representatives are also given:—

G.C.A. (lettering and design). No. 433,754. Class 13.—Appliances for installing and removing electric light bulbs, lamp sockets, fuse plugs, &c. The G.C.A. Manufacturing Co., 92, Renne Avenue, Pittsfield, Mass., U.S.A. (Abel and Imray, 30, Southampton Buildings, Chancery Lane, London, W.C.) January 16th, 1924.

Eltax. No. 441,467. Class 8.—Electrical accumulators and batteries (not for medical purposes). Eltax Electro Gesellschaft, 96, Charlottenstrasse, Berlin, S.W.68. (Boult, Wade and Tennant, 112, Hatton Garden, London, E.C.) January 23rd, 1924.

Frenophone. No. 441,468. Class 8.—Sound producing and reproducing appliances. S. G. Brown, Ltd., Victoria Road, North Acton, London, W. January 23rd, 1924.

Miniwatt. No. 442,592. Class 8.—Electric lamps (philosophical), telegraphic and telephonic instruments, and apparatus. No. 442,593. Class 13.—Electric lamps (ordinary), electric discharge tubes, &c. Naamlooze Vennootschap Philips Gloeilampenfabriek, Eindhoven, Holland. (Boult, Wade and Tennant, 112, Hatton Garden, London, E.C.) January 23rd, 1924.

Celcousse. No. 443,125. Class 8.—Detector crystals for use in wireless telephony. Coussell Bros., 2, Fairfield Road, Kingston-on-Thames. January 23rd, 1924.

Pixite. No. 443,253. Class 8.—Apparatus used in wireless telephony. Houghtons, Ltd., Ensign House, 88-9, High Holborn, London, W.C. January 23rd, 1924.

Pyrox. No. 442,164. Class 18.—Electrical domestic heating and cooking apparatus. Aktieselskabet De Norske Saltverker, 71, Kong Oskarsgate, Bergen, Norway. (McKenna & Co., 31-34, Basinghall Street, London, E.C.) January 23rd, 1924.

Lewbestos. No. 442,591. Class 50.—Wire covered with asbestos. The London Electric Wire Co. and Smiths, Ltd., 7, Playhouse Yard, Golden Lane, London, E.C. January 23rd, 1924.

Hand and Lightning Design. No. 433,798. Class 8.—Electrical instruments and apparatus for use in connection with fire alarms and police signalling systems. The Gamewell Fire Alarm Telegraph Co., 70, East 45th Street, New York, U.S.A. (White, Langner & Co., Jessel Chambers, Chancery Lane, London, W.C.) January 30th, 1924.

Omnifier. No. 443,282. Class 8.—Instruments and apparatus for use in wireless telephony and telegraphy. Radio Accoustics, Ltd., 175, Peckham Park Road, London, S.E.15. January 30th, 1924.

Carlet. No. 440,414. Class 8.—Measuring instruments and apparatus, electrical resistances, telephonic instruments, &c. Carl Lindstrom Gesellschaft, 26, Schlesischestrasse, Berlin, S.O.53. (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.) January 30th, 1924.

Parlographon. No. 440,415. Class 8.—Measuring instruments and apparatus, electricity meters, electrical resistances, &c. Carl Lindstrom Gesellschaft, 26, Schlesischestrasse, Berlin, S.O.53. (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.) January 30th, 1924.

Vitrohm. No. 441,810. Class 8.—Electric resistance units, rheostats and regulators. The Ward Leonard Electric Co., Pearl Street, Mount Vernon, New York, U.S.A. (Abel and Imray, 30, Southampton Buildings, Chancery Lane, London, W.C.) January 30th, 1924.

Ribohm. No. 441,811. Class 8.—Electric resistance units, rheostats, and regulators. The Ward Leonard Electric Co., Pearl Street, Mount Vernon, New York, U.S.A. (Abel and Imray, 30, Southampton Buildings, Chancery Lane, London, W.C.) January 30th, 1924.

(Design). No. 442,960. Class 8.—Wireless telegraphy and telephony apparatus, instruments, and contrivances. Midland Valves, Ltd., Trelco Works, Sherborne Street, Ladywood, Birmingham. January 30th, 1924.

Lighting and Power Notes.

Australia.—COWRA (N.S.W.).—The Municipal Council has received Government sanction to the borrowing of £23,000 for an electricity supply in the town. A temporary plant has been installed in order to carry out an agreement to give a supply to the Railway Department from the commencement of this year.

Barnstaple.—NEW PLANT.—The Town Council has received the sanction of the Electricity Commissioners to the installation of a 300-kW generating set in place of the second 500-kW set for which sanction was given in 1920.

Bexhill.—NEW PLANT.—The Corporation has decided to replace the two small "Allen" generating sets by a 1,250-1,500 kW, geared turbo-generator, at a cost of £7,200.

Bridgend.—NEW PLANT.—The chairman of the Electricity Committee has reported to the Council that the plant at the electricity works is working to full capacity, and in order to meet the increased demand for electricity the Committee has decided to increase the generating plant by the installation of one 1,000-kW set, at a cost of £7,000.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Gatineau Company, which has its head office in Montreal, is seeking authorisation to develop nearly 100,000 h.p. at Chelsea Falls by constructing a dam eight miles north-west of Hull. This development, according to information available, will cost between $3,000,000 and $4,000,000; at first, half of the total horse-power mentioned will be harnessed and utilised.—*Reuter's Trade Service* (Ottawa).

HYDRO-ELECTRIC DEVELOPMENT.—Work in connection with the erection of a hydro-electric power station at Calumet Falls, Ottawa River, has been commenced by the Ottawa River Power Co., Ltd. The initial development includes the installation of one 22,500-kVA generator, and provision will be made for two additional generators each with a capacity of 22,500 h.p. for the ultimate development of 67,500 h.p. A dam is to be constructed across the river, from which the water will be conveyed to the power station by means of a canal. A transmission line 50 miles in length has been erected from Hull to the site of operations, which will supply the electrical energy for the construction work. When this is complete the transmission line will be used for the supply of electricity from the power station to Hull.—*Electrical News.*

China.—CANTON.—A new Curtis turbine of 500 kW is being installed by the Canton Merchant Electric Supply Co., Ltd., with two 750-h.p. Stirling boilers and the necessary auxiliaries and equipment, according to the *Bulletin* of the Chinese Economic Information Bureau. At present the plant at the works consists of one Diesel engine, 2,500 h.p., two turbines of 2,500 kW each. This company has about 23,000 consumers, and the yearly output is about 16,000,000 kWh.—*Eastern Engineering.*

Chosen.—YALU HYDRO-ELECTRIC SCHEME.—A survey of the hydro-electric resources of the Peninsula has been undertaken. It is proposed to erect a power station on the Yalu River, which will be capable of supplying 35,000 h.p. during the summer season and 10,000 h.p. in the winter season, when the river is ice-bound. The estimated total supply of the Peninsula is 1,000,000 h.p., of which the Yalu River, with its tributaries, would yield 700,000 h.p. It is anticipated that a supply will not be available for three or four years, even if the present scheme is carried out.

(*Continued on page 223.*)

A Sicilian Hydro-Electric Installation.

The Palermo Undertaking.

By Major J. S. BARNES.

THE Belice hydro-electric scheme, lately completed near Palermo, is of particular interest both from the technical point of view and from the fact that it is a typical instance of the schemes specially adapted to the peculiar conditions of Southern Italy.

Here the rivers for the most part can hardly be described as rivers at all. In summer they dwindle to mere gutters, and often dry up altogether. The rainfall is low, and when it rains it rains in torrents, so that the ancient rocks which characterise the greater part of the country, being of an impermeable nature, the precious water runs swiftly to waste in the sea, causing enormous damage by erosion and flood on its way, and creating conditions in the plains favourable to the spread of malaria. Moreover, in the summer, when the water is chiefly needed by agriculturists for irrigation, it is not available.

Fig. 1.—View of the Belice Dam.

The problem to be solved accordingly is a compound one: the provision of the means for generating a constant supply of electrical energy by impounding the waters in relatively large artificial lakes; the restoration of a permanent flow of water into the river bed at such a level above the sea that it can be further utilised for the purpose of irrigation at all seasons of the year; and the prevention of erosion floods and, indirectly, of malaria.

The Belice scheme fulfils all these purposes, and at the same time, since the watershed at the back of Palermo is close to the coast, providing an insufficiency of water for large power production, it is interesting in that it makes use of the headwaters of streams beyond the Palermo catchment area, diverting them from their natural exit into the African Sea on the south-west coast of Sicily and transferring them across the watershed to mingle their waters with the streams flowing north into the Tyrrhenian Sea.

The Belice plant is the largest so far constructed in Sicily by the Società Generale Elettrica della Sicilia, which, under the enterprising direction of Commendatore Vismara, has created three other important hydro-electric stations and a number of thermal plants, closely co-ordinated for the supply and distribution of

Fig. 2.—Interior of Turbine Room.

power. The plant under review was designed by the greatest of Italian water engineers, Commendatore Angelo Omodeo, on the basis of original plans submitted by Signor Drago, deputy for Palermo, and was constructed under the personal supervision of Ingegnere Sartori. The dam was designed by Ingegnere Mangiagalli, Commendatore Omodeo's principal collaborator.

It consists, in the first place, of a main storage reservoir situated in the Magannuci Valley, near the Albanian village of Piana dei Greci, about eight miles south of Palermo, at a height above sea level of over 2,000 ft. The reservoir is 3,360,000 square metres in area when full, and has a total capacity of 32,800,000 cubic metres, of which 21,000,000 cubic metres may be drawn upon.

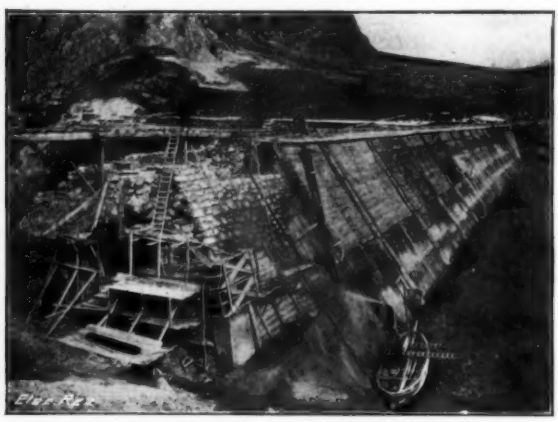

Fig. 3.—The Dam under Construction.

The catchment area tapped is 40 square kilometres, the greater part of which belongs to the southern slopes of the watershed.

The reservoir is formed by means of a dam constructed at the entrance to the Hone Gorge, into which the waters of the Belice Torrent, flowing south into the African Sea, used to plunge. The dam is 133 ft. in height above its foundations, 866 ft. long, and has a base 223 ft. wide. It is dry-built of stone, quarried on the spot. Its foundations are of reinforced concrete, and it is ren-

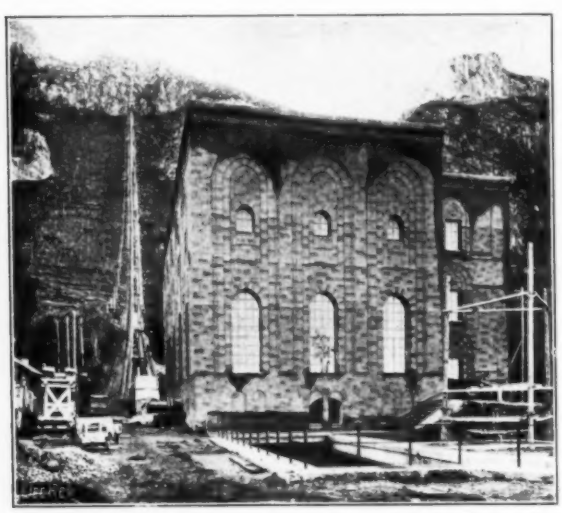

Fig. 4.—Power House and Pipe Line.

dered waterproof by means of a concrete lining on the lake side, two metres thick, which is continued about ten metres below the level of the foundations, the whole being covered with gun cement, both externally and internally. The dam is traversed by three galleries, accessible throughout its length and connected with a number of vertical and horizontal drains, so that the smallest percolation of water through the concrete lining into the dry-built masonry may be immediately observed and dealt with.

The dam stands four metres above the maximum level of the water. Any further rise of water due to exceptional rains is prevented automatically by a surface outlet, capable of discharging up to 100 cubic metres per second. There is an emergency outlet by tunnel at the base, operated by a steel butterfly valve.

Fig. 5.—Sketch Map of the District.

The flume which brings the water from the storage reservoir to the head reservoir or forebay has a length of 8.2 miles. The first portion is under pressure, and is furnished with locks; the remainder, partly in tunnel and partly on the surface, but with a concrete covering throughout its length, is designed to carry up to two cubic metres of water per second.

Owing to the great length of the flume, a large head reservoir is required, actually the largest in Italy, and sufficient to meet all daily variations of power up to a peak load calling for the utilisation of three cubic metres of water per second. Its capacity is 54,000 cubic metres.

A pressure tunnel, 850 metres in length, connects the

Fig. 6.—View of Dam.

head reservoir with the head of the pipe line, at which point is constructed a surge tower 133 ft. in height (partly excavated in the rock), with an automatic butterfly valve.

The pipe line, which dives into the Conca d'Oro (the Valley of Palermo) at an inclination of 1 in 1, is composed of 6-metre welded steel pipes, with a diameter varying from 1.2 to 0.85 metre, and having a thickness of from 7 to 33 millimetres. It was made at Kattowitz. The mean head is 1,550 ft., and both the pressure tunnel and the pipe line are designed to carry a maximum of three cubic metres of water per second.

The power house is a building in the Sicilian Norman style, measuring 35 metres by 21 metres. In the engine room, 29 by 12 metres, are four Pelton wheels (750 revolutions per minute), each of 3,500 brake h.p., supplied by Messrs. Riva; these are connected directly with four

three-phase alternators of 2,400 kW each, generating at 10,200 volts, with exciters on a common shaft, supplied by Messrs. Tosi. The remaining electrical plant, including the switchboard and safety appliances, all supplied by Messrs. Magrini & Co., of Bergamo, is housed in four rooms on two upper floors. A peak load of 9,600 kW may thus be met. The operatives are accommodated in a house next door, built in the same style.

The water is discharged into a canal 2,285 metres long, connected with the small river Oreto. Part of the water, however, is conducted into a third reservoir, built for the purpose of impounding the water for irrigation, the area irrigated amounting to 3,750 acres.

The transmission line is overhead, and is connected with the thermal power station of Palermo, which provides the constant load. A second water-power station is projected to utilise the discharge into the river Oreto, at which point there is a drop of another forty metres. As soon as the first stages of the Sila scheme in Calabria are completed, additional power will be made available for Sicily over the Straits of Messina, when the above-mentioned plants are to be connected with a main high-pressure transmission line joining up Messina, Palermo and Catania.

The Sila scheme, which has been previously referred to in the ELECTRICAL REVIEW, is of a very ambitious character, and is destined to confer great benefits on the provinces of Calabria and Apulia. These provinces, bounding the Gulf of Taranto on the south and north respectively, form the toe and heel of the peninsula; especially in the district of La Sila, and the Sila company has been formed to provide a supply of electricity to Lower Italy amounting to 1,000,000,000 kWh a year.

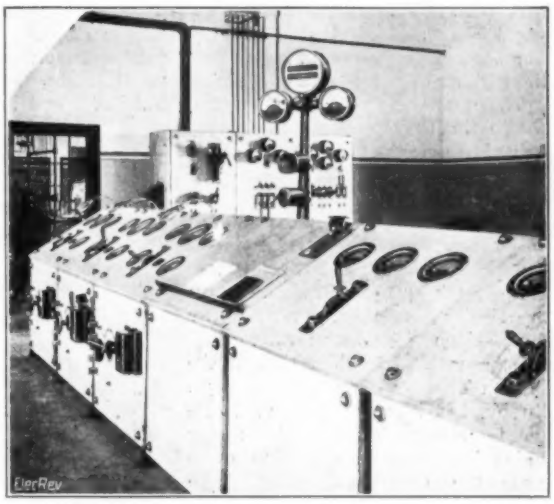

Fig. 8.—Control Board.

Many other large hydroelectric schemes are in course of execution, and it is estimated that within a few years the Italian generating stations will be capable of an aggregate output of more than three million horse-power, the capital invested in these undertakings amounting by that time to 5,000,000,000 lire. It is fortunate for Italy that Nature has endowed her so abundantly with waterfalls, seeing that she is practically devoid of fuel deposits, though she owns in Tuscany certain sources of "natural steam" which have been applied to the generation of electrical energy. These are situated at Lardarello, near Volterra—a name significant of subterranean fires— and have for over a century been utilised for the extraction of chemical substances brought up by steam jets, called "soffioni," from pits or bore-holes. Twenty years ago the jets were first used to drive steam engines, and in 1913 steam boilers and a turbine were installed; the success of this plant led to the erection of turbine plant capable of giving an output of 9,000 kW, which was supplied in bulk to the electricity undertakings of the province at a pressure of 36,000 volts.

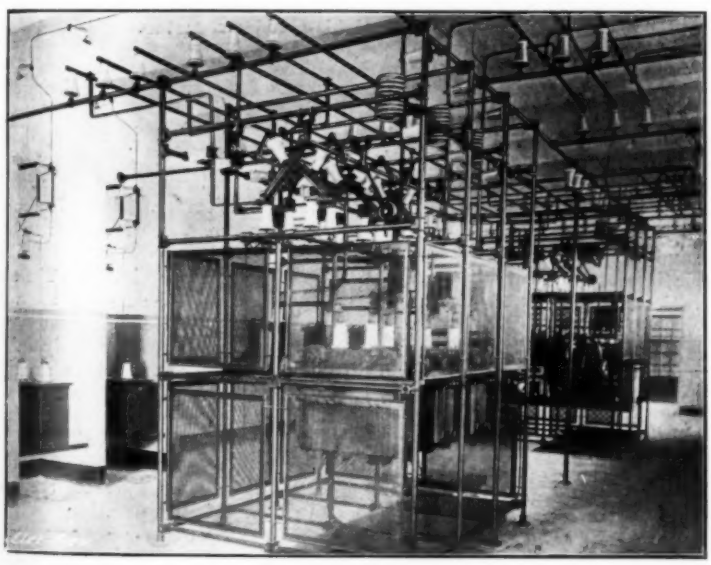

Fig. 7.—High-Pressure Switchgear.

Apulia is mainly low-lying country, but Calabria is largely mountainous and possesses numerous rivers,

Variable-Speed Drives for Calico Printing Machines.

The B.T.H. Alternating-Current Motor.

PRINTING is certainly one of the most important processes through which calico fabric passes and, in consequence, much consideration has been given in recent years to suitably driving the printing machines.

Efficient speed control, both for correctly setting the printed patterns and also for drying the fabric in a suitable manner after printing, is an essential feature governing the commercial efficiency of the printing plant. Recently many applications of individual electric motor drives have been introduced and, on alternating-current systems, the desired speed changes have been obtained by the use of a slip-ring induction motor with resistances inserted in the rotor circuit. This system has shown that electric drives for such machines are quite feasible; in fact, they are very successful, but, at the same time, this particular method of driving has a

serious inherent defect. The speed variations are obtained only with loss of energy in the rotor resistances and, for the same torque, the power taken from the supply mains is the same at all speeds as that required when driving at the maximum speed. Further, the speed changes are limited to very definite steps, the number of speeds available being entirely dependent on the number of points on the main controller.

The waste of energy and the instability of speed involved in this particular form of drive have necessitated very careful research in order to increase the efficiency of the drive and to ensure that, as far as possible, the amount of power consumed shall vary with the speed. Also, it is essential that, at any setting, the speed shall remain practically constant, even under fluctuations of load and voltage.

As a result of this research, the British Thomson-Houston Co., Ltd., Rugby, has introduced a variable-speed alternating-current motor which has been developed to overcome the objections stated and which, in the first equipment installed, has proved an unqualified success; so much so, in fact, that a second machine was ordered immediately for the same works.

An interesting example of this type of drive is that of a 5-colour printing machine, supplied by Messrs. Mather & Platt, Ltd., to the works of Messrs. Mark Fletcher and Sons, Ltd., Whitefield, near Manchester. This machine, illustrated in fig. 1, is capable of printing cloth 42 inches wide at any speed varying from 60 to 20 yards per minute, and this speed is capable of further reduction, for setting purposes, to a cloth speed of 7 yards per minute. Chest and cylinder drying apparatus is provided for the printed fabric, and a washing blanket is incorporated with washing and drying cylinders. The drying of the printed fabric is effected by first passing it in close proximity to a series of steel chests heated by high-pressure steam, and then over the usual copper cylinders carried on a vertical frame. The blanket passes from the printing machine to the washer, after which it is dried by passing over copper rollers and, before it re-enters the printing machine, is cooled by passing in vertical laps over a number of iron rollers.

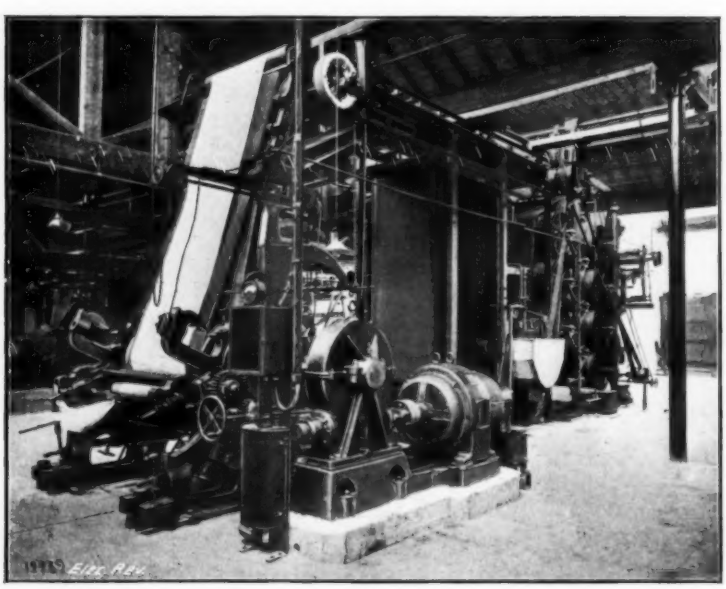

Fig. 1.—Mather & Platt Calico Printing Machine.

The B.T.-H. motor driving this machine,* fig. 2, is a 400-volt, 3-phase, 50-cycle machine, capable of a speed variation of 3 to 1 with constant torque. The actual speed range is from 350 to 1,050 r.p.m., with an output of 10 h.p. at the former speed and 30 h.p. at the latter. The motor is of the enclosed ventilated type, fitted with perforated metal covers, which are mounted on hinges so that, while all live parts are inaccessible while it is in operation, it is a simple matter to obtain access to the inner parts of the machine for inspection and cleaning purposes.

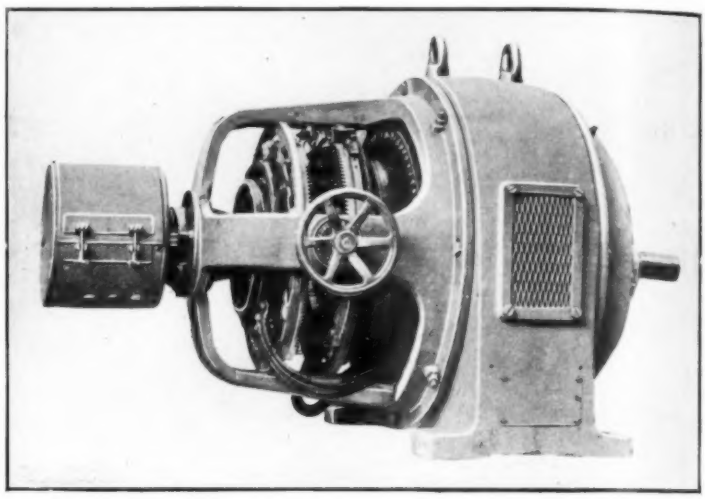

Fig. 2.—B.T.-H. Variable-speed a.c. Motor.

The electrical construction of this motor differs generally from that of the ordinary induction motor in that the primary winding is on the rotor and the secondary winding is carried in the stator. There is also an additional winding on the rotor, which is connected to a commutator, speed regulation being obtained by altering the position of the brushes of the latter. The connections, and hence the wiring of the motor, are very simple, it being necessary only to carry the three main supply cables from a simple triple-pole starting switch direct to the rotor of the machine. The very low speeds for setting purposes are obtained by the insertion of resistances in the stator circuit, and six terminals are provided for this purpose.

This type of motor has practically the same characteristics as a direct-current shunt-wound motor, with speed regulation by field control, but there are notable improvements in that the speed does not vary to the same extent with differences of temperature; further, with this type of motor no external resistances are necessary for ordinary speed regulation, this being effected by simple movement of the brush gear. A hand wheel is provided to rotate the brush gear to any required position on the commutator; or, if desired, this adjustment for regulation of the speed can be effectively produced by push-button control, when the brush gear is rotated by means of a small motor mounted on the end-shield of the main motor.

The amount of power taken from the supply mains is proportional to the motor speed, and the printing machine speed can be set at any desired point within the range of the running speeds of the motor. This feature

*The motors referred to are protected in this country by Patent No. 25,358/11.

is of extreme service, the actual speed of the cloth being obtainable, not in so many steps, but in a steady continuous advance.

Creeping speeds on a printing machine can be obtained without the use of resistances if a change-speed gear is inserted between the motor and the machine to give a 1:1 gear ratio when printing and a 5:1 ratio when setting and testing the patterns. In this manner even greater running efficiency and still more satisfactory operating results can be obtained than those available with the resistance method of control. With this system also the control gear necessary is considerably simplified.

The steady crawl obtained by this system of control is of great commercial value, not only because of the saving of time and increase of production, but also, incidentally, because of the reduced amount of cloth which is wasted during the setting operations and when testing and matching patterns. The time required to increase the speed from the minimum to any desired value is only a few seconds and, consequently, it is possible to print at the maximum speed practically all the time the machine is running. Also for the convenience of the operator, all control points may be arranged near the place from which the colour rolls are adjusted.

Lighting and Power Notes.

(*Continued from page* 218.)

Burnley.—INQUIRY.—An inquiry into the application of the Corporation and Lancashire Electric Power Co. for sanction to erect a generating station near Padiham will take place at Burnley Town Hall on February 27th.

Continental.—FRANCE.—An appeal for an increased development of French resources of water power is made by M. Buffault, of the water and forestry services, in the *Revue Générale des Sciences*. M. Buffault points out that in 1922 the consumption of fuel amounted to nearly 65 million tons, including 9 million tons (14 per cent.) for the railways and 12½ millions (19 per cent.) for metal industries. An estimate of French coal reserves has placed the total at 18 milliard tons. The total water power in France has been estimated at an average of 10 million h.p. M. Buffault contends that the 65 million tons of fuel at present consumed in France each year could be entirely replaced by water power, amounting to 8,220,000 h.p., or 80 per cent. of the maximum water power in the country. Before the war, only 800,000 h.p. of water power was exploited, but since 1916 this amount has increased to 1,775,000 h.p., principally in the Alps (58 per cent.), the Pyrenees (20 per cent.), and the Central Plateau (15 per cent.). In fifteen years it is hoped that this total will have been increased to 3,000,000 h.p., 760,000 of which should be furnished by the barrages to be constructed on the Rhone.—*Reuter* (Paris).

AUSTRIA.—The available water horse-power in Austria is estimated at 4 millions, of which 2 millions can actually be utilised. Of this amount, at the end of 1920 only 325,000 h.p. had actually been put to practical use. The following schemes have been agreed upon in various parts of the country:—Salzburg, Steiermark, Karnten, Tirol, Vorarlberg, and Burgenland.

GERMANY.—The strike of the brown-coal miners of the Rhenish Westphalian Electricity Works is complete, the 800 workers at the Donatus mine, the only one which had not been affected, having been now compelled to join in the strike. Only British requisitioned labour is now at work.—*Reuter* (Cologne, January 31st.)

Coventry.—LOAN.—The City Council has confirmed an application being made to the Electricity Commissioners for sanction to a loan of £3,375 for the extension of mains at Whitley and Aldermoor Lane.

East Kent.—APPLICATION FOR ORDER WITHDRAWN.—The local authorities have been informed that the application for the East Kent Electricity Order has been withdrawn, owing to opposition on the part of Sandwich Town Council, the Eastry and Dover Rural Councils, and other authorities.

Freshwater and Totland.—ELECTRICITY SUPPLY.—Residents in the district have contributed the necessary sum to a guarantee fund for preliminary expenses in connection with an electric lighting scheme put forward by Edmundson's Electricity Corporation, Ltd., and the Isle of Wight Electric Light and Power Co., Ltd. Half the necessary capital has been guaranteed by these two companies, leaving from £8,000 to £10,000 to be raised locally, and towards this over £2,500 has been promised. It is proposed to supply electricity at 1s. per kWh.

Hebden Bridge.—ELECTRICITY SUPPLY.—In view of the expiry of the agreement with the Halifax Corporation for a bulk supply of electricity in September, the Council has decided to ask the Corporation upon what terms it would be prepared to renew the agreement.

Ilford.—PROPOSED NEW POWER STATION.—The Urban District Council has applied to the Electricity Commissioners for consent to establish a generating station on a site at the refuse destructor works in Suffolk Road.

Irish Free State.—THE LIFFEY POWER SCHEME.—Official notices have been published of the intention of three companies to seek power in the Free State Parliament for the electrical development of the water power of the River Liffey. The Anna Liffey Power Development Co. wishes to carry out the scheme favoured by Sir John P. Griffith, which would make 53 to 55 million kWh per annum available to Dublin at a cost of £1,200,000. The Irish Power Syndicate proposes to erect works at the Eveden Falls, Poulaphouca, and at Leixlip and Blackwood, Co. Kildare; and the Liffey Syndicate proposes a scheme for distribution of electricity in the Counties of Dublin, Wicklow, and Kildare. The three Bills will be presented to Parliament in the present Session.

Knaresborough.—ELECTRICITY IN BULK.—A canvass of prospective consumers having proved satisfactory, the Urban District Council has decided to take a supply of electricity in bulk from Harrogate Corporation for a period of ten years.

Manchester.—EXTENSION OF SUPPLY.—A canvass of the Barton and Urmston districts of Manchester has revealed a considerable demand for electricity both for domestic and lighting purposes. A scheme is under consideration whereby a supply may be obtained from the Barton station of the Corporation or from the Stretford Council, which has arranged to take a bulk supply from the Barton station. It is proposed to obtain an a.c. three-phase supply at a pressure of 6,600 V.

Mold.—ELECTRICITY SUPPLY.—Representatives of the Urban District Council have had a meeting with the North Wales Power Co., Ltd., and the Gwynedd Trust, Ltd., at which it was stated that the Power Co. hoped to give a supply of electricity to Mold by next winter. The proposals of the Gwynedd Trust to carry out arrangements for the distribution are to be considered by the Council at a later date.

Morecambe.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £4,000 for mains and services in connection with the change-over from gas to electric lighting in the Heysham district.

Preston.—PROGRESS OF NEW STATION.—At a meeting of the Town Council on January 31st it was stated that good progress was being made with the new power station, and that it was anticipated that it would be brought into operation by the end of May.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

COULSDON AND PURLEY.—Lighting: From 50 per cent. to 40 per cent. above the pre-war rate. Power and heating: From 60 to 50 per cent. above the pre-war rate.

WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.—Lighting: A reduction of ¼d. per kWh. Power and heating: A reduction of ¼d. per kWh as from April 1st.

NORTH BERWICK.—*North Berwick Electric Light and Power Co., Ltd.*—Lighting: From 1s. to 10d. per kWh. Power and heating: From 6d. to 3d. per kWh.

BLACKPOOL.—The increase on pre-war charges to be reduced from 25 per cent. to 10 per cent.

South Africa.—CAPE TOWN.—According to the *Cape Times*, preparations are well advanced for the electrification of the Cape Town suburban railways. The Electricity Commission has called for tenders for the erection of an undertaking to supply electrical energy to the local lines. An agreement has been arranged between the City Council and the Commission covering the following points:—The Municipality will not tender for the new undertaking. A new power station will be erected by the Electricity Commission in the vicinity of the mouth of the Salt River. This station will be interconnected with the Dock Road municipal undertaking and an interchange of current will be effected at cost price. In order to obtain the highest efficiency at both stations, the city electrical engineer will manage both.

BULAWAYO.—The Municipal Council has given notice of its intention of purchasing the electricity undertaking of the Bulawayo Waterworks Co. The purchase price will be determined by arbitration.

Stevenage.—SPECIAL ORDER.—The Stevenage Electric Light and Power Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the Urban District of Stevenage and in the parishes of Graveley and Knebworth in the area of the Hitchin Rural District Council.

West Riding (Aire and Calder) Electricity District.—LOCAL INQUIRY.—With reference to the postponement of the local inquiry in respect of the draft Order embodying the scheme for the reorganisation of the supply of electricity in the above-named electricity district, the Electricity Commissioners have decided to commence the inquiry on February 13th, at 10.30 a.m., in the Council Chamber, Town Hall, Bradford.

Tramway and Railway Notes.

Blackpool.—TRACK RENEWALS.—The Tramways Committee is to reconstruct the tramway track in Central Drive, between Chapel Street and Ashton Road, and to complete the work by Easter.

Bradford.—LOAN.—The Finance Advisory Committee has given authority to the application to the Ministry of Transport for sanction to borrow £126,591 for tramway track reconstruction. The application is to be made pending decision of the question whether the track should be relaid or displaced by railless services.

NEW TYPE OF CAR.—In the event of powers being obtained to run railless cars to Clayton, the tramway general manager (Mr. R. H. Wilkinson) has designed a new large single-deck car. The entrance is in the centre of the car, with a smoking compartment at one end and a non-smoking compartment at the other.

Continental.—AUSTRIA.—Work in connection with the electrification of the railways is progressing, and it is considered that during the next two years substantial progress will have been made, and that early this year electrical operation will have been adopted as far as Landeck, on the Innsbruck to Telfs line, and also on the Stainach to Irdning line as far as Bad Ischl. By the end of 1924 it is anticipated that the whole of the Salzkammergut line, Stainach to Irdning, and Attnang to Puchheim, will have been completely converted, whilst by the beginning of 1925 electric traction will be employed between Innsbruck and Bludenz. The expenditure since work began in 1919 amounted to approximately 375,000,000,000 crowns up to the end of November, 1923. During 1924 a Budget allocation of 300,000,000,000 crowns has been made. If the constructional programme is carried out, about 270 kilometres of the Government railways will have been electrified by the beginning of 1925. The conversion that has already been made has led to a notable saving of coal, which in 1924 will, it is expected, represent the sum of 25,000,000,000 crowns.

Dearne Valley.—LIGHT RAILWAY.—The opening of the Dearne Valley light railway, which is to link Wath, Bolton, Wombwell, and Thurnscoe with Barnsley, is to take place in the spring, probably at the end of April. Sanction has been obtained to the construction of four other lines at a cost of £25,000, making the total cost of the whole scheme £275,000.

Hull.—PROPOSED ABOLITION OF LEVEL-CROSSINGS.—At the meeting of the Corporation Tramways Committee on January 28th it was reported that the profit on the tramway for the past year was £56,000. It is suggested that in future some of the profits be taken to help to abolish the level-crossings in the city which hold up traffic for one-third of each hour. The estimated cost of carrying out this abolition is £1,000,000, and it is suggested that the cost be shared by the Corporation, the L.N.E.R., and the Government.

Middlesex.—PROPOSED TUBE EXTENSION.—The Middlesex County Council has decided to make representations to the Premier and the Ministers of Transport and Labour with a view to the extension of the tube from Finsbury Park northwards at an early date.

Middlesbrough.—The Tramways Committee has instructed the borough engineer to prepare alternative schemes for a tramway, light railway, railless cars or omnibuses linking up the town with Marton Hall, a mansion two or three miles outside the borough.

Preston.—NEW TRACK.—The Tramways Committee has recommended the Council to lay a double track in Ribbleton Avenue from Style Fields to Cedar Road at a cost of £2,500.

Southport.—INQUIRY.—The Ministry of Transport held an inquiry on January 24th into the proposal of the Corporation to construct a new tramway track in Eastbourne Road and Kew Road, Birkdale, at an estimated cost of £24,000. The length of the track required is 850 yards. It was submitted that by the extension of the tramways, as suggested, the building of working-class property would be encouraged.

Telegraph and Telephone Notes.

Atlantic Cables.—REPAIRS.—The Telegraph Cable Maintenance and Repairing Co.'s ship *Telconia* arrived in Cork Harbour last week from Valentia, Co. Kerry, where she had been effecting repairs to cables for the past two months. She took in coal at Queenstown, and other requirements, and proceeded to sea again, to a spot about 60 miles west from Valentia, there to start repair work on a transatlantic cable. The *Telconia* has a gross tonnage of 1,200 and is commanded by Capt. L. Hoad, O.B.E.

International Telephone Trust.—AN AMERICAN DENIAL.—With reference to the suggestion that the American Telegraph and Telephone Co. is associated with the International Telephone and Telegraph Corporation in planning a world telephone trust (referred to in our issue of January 18th, 1924), Mr. H. B. Thayer, president of the American T. & T. Co., has issued an official statement denying that any such association exists.

Lithuania.—NEW RADIO STATION.—It is stated by *l'Electricité* that a French company has secured the contract for the installation of a wireless station at Kovno, in Lithuania, notwithstanding the competitive offers of two big firms, one German and the other English. The value of the material to be supplied is 1,026,000 fr., and delivery is to be made within six months. The quotation for erection is 100,000 fr., with a delay of three months. The contract was signed on October 29th last.

Manchuria.—NEW TELEPHONE LINE.—It is reported that the scheme proposed by M. Lepissier, French Consul at Harbin, for the construction of a long-distance telephone line in Manchuria under Sino-French control has been approved, and a company is in progress of formation. The new line is to start at Pogranichnaya, on the borders of North Manchuria and Siberia, running westward to Manchouli the western terminus of the Chinese Eastern Railway. In time, it is to connect with Vladivostok on the east, and Chita on the west. The new company is to be capitalised at S.Y. 1,000,000, to be paid up in full between the French and Chinese sides. Sixteen years hence the new telephone system is to pass into Chinese hands unconditionally.—*Eastern Engineering.*

Mexico.—NEW RADIO STATIONS.—It is reported that the Mexican Government has placed an order with a German company for the erection of four large radio stations in the Republic to connect the capital with the neighbouring Republics of Guatemala, Costa Rica, San Salvador, and Nicaragua.—*Financial Times.*

Radio at Sea.—DUPLEX OPERATION.—On the homeward voyage of the Cunard liner *Aquitania*, which reached Southampton on February 1st, the chief radio officer, Mr. C. V. Maudsley, accomplished the feat of receiving two messages simultaneously on wave lengths of 2,200 and 600 metres. Two aerials were used, and it is reported that the experiment was so successful that it has been decided to adopt the scheme permanently.

The Telephone Service.—NEW LIVERPOOL EXCHANGE.—A new telephone exchange was recently put into service at Liverpool, the old Royal Exchange being replaced by a new one with 4,500 subscribers' and 650 junction lines. The new exchange is of the manual central-battery type and will ultimately provide 10,000 subscribers' lines.

United States.—ALLEGED RADIO MONOPOLY.—The Federal Trade Commission charges the principal corporations engaged in the manufacture and distribution of radio equipment, and the rendering of radio service, with creating and maintaining a monopoly in radio apparatus and communication. The various companies were cited (January 27th) to answer within thirty days a charge of violating the law regarding unfair competition.—*Reuter* (Washington).

Radio Notes.

Irish Free State.—BROADCASTING COMMITTEE.—The interim report of the Special Committee appointed by Dail Eireann was submitted to Parliament on the 1st inst. It states that the widespread rumours affecting the integrity of the Postmaster-General are wholly baseless. It expresses the conviction that the control of broadcasting in the Irish Free State must be rigorously preserved as a national control, and that the transmission service must not be permitted to become a private monopoly. It formed the decided opinion that it is desirable to have, at least, one broadcasting station, and that of the constituent units of the proposed Irish Broadcasting Co. some have no connection whatever with the manufacture of radio apparatus, some were called into being to figure as "constituent firms," and one at least has only financial interest in the exploitation of broadcasting. The broadcasting concession should not be extended to the Irish Developments, Ltd., one of the constituent firms. Deputy Darrell Figgis, who was connected with the above-named firm, and was a member of the Committee of Inquiry, has resigned.—*Manchester Guardian.*

According to *The Times*, the report recommends that licences for the use of receiving sets ought to be issued by the Postmaster-General pending the establishment of the Irish station, and suggests a temporary flat rate of, say, £1 per year. During the course of the inquiry the Committee asked the Postmaster-General to stay his decision to seize all radio sets in the Free State, and Mr. Walsh assented readily.

Radio-Broadcasting.—GREENWICH TIME SIGNALS.—On February 5th, the Astronomer Royal, Sir Frederick Dyson, delivered an address from the London broadcasting station on the inauguration of time signals from Greenwich Observatory. Greenwich mean time signals will be relayed each day at 3.30 p.m. and 9.30 p.m., and on Sundays at 10 p.m. The British Broadcasting Co. is also making arrangements to broadcast the chimes of Big Ben.—*The Times.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—February 18th. Electricity Department. Two water-tube boilers, with superheaters, economisers, draught fans, steel chimney, piping, and accessories. (January 25th.)

Australia.—MELBOURNE.—March 19th. Victorian Railways. One electrically-driven air compressor.*

Barking. — February 19th. Electricity Department. Feeder and distributor cables. (February 1st.)

Belfast.—March 4th. Tramways Committee. Twelve months' supply of stores, including cable, lamps, carbon brushes, &c. (See this issue.)

Belgium.—Tenders have this week been invited by the municipal authorities of Lierneux (Province of Liége) for the concession for the supply of electricity in the town.

February 14th. Municipal authorities of Basse-Bodeux (Province of Liége). Concession for the supply of electricity in the town.

February 21st. Municipal authorities of Brussels. Bronze cable connectors for 12 months and supply of circuit-breakers. Specifications in respect of the two contracts can be obtained for 2 fr. each.

Birmingham.—February 16th. Electricity Committee. Supply of d.c. motors (approx. 250, from ½ b.h.p. to 20 b.n.p.); starting panels. (See this issue.)

Bradford.—February 21st. Electricity Department. Five 2,500-kVA, 3-phase transformers; m.p., d.c. switchgear; 6,600-V armour-clad switchgear, &c. (February 1st.)

Caistor (Lincs.).—February 16th. Board of Guardians. Electric lighting installation at the Institution, including engine, dynamo, wiring, &c. Mr. A. A. Padley, Clerk, Union Offices, Caistor.

Colwyn Bay and Colwyn.—March 6th. Urban District Council. Sewerage pumping machinery, including three 10-b.h.p. electric motors. Mr. Robt. Green, chartered civil engineer, 37, Bennett's Hill, Birmingham.

Denmark.—COPENHAGEN.—April 2nd. Lighting Department. 6,000-V and 30,000-V switchgear.*

Dover.—March 17th. Electricity Department. One water-tube boiler. (See this issue.)

Dun Laoghaire (Kingstown) (Co. Dublin).—February 21st. Urban District Council. Crude oil engines and alternators; switchgear and transformers, distribution system (underground and overhead). (See this issue.)

Edinburgh.—February 11th. Electricity Supply Department. E.h.p. and l.p. switchgear for sub-stations. (January 25th.)

Egypt.—CAIRO.—February 14th. Director-General, Section of Municipalities and Local Commissions, Savoy House, Cairo. Electrical works at Mit-Ghamr.—*Reuter's Trade Service* (Cairo).

Glasgow.—February 13th. Corporation. Electric lighting installation in connection with the Knightswood housing scheme. Mr. R. B. Mitchell, city electrical engineer, 75, Waterloo Street.

London.—METROPOLITAN WATER BOARD.—February 13th. Six or 12 months' supply of electric lamps. Chief engineer, New River Head, 173, Rosebery Avenue, E.C.1.

H.M. OFFICE OF WORKS.—February 12th. Electrical accessories; electric light wire and cable. (February 1st.)

ISLINGTON.—February 25th. Electricity Department. Two electric dust collection vehicles, fitted with steel tipping bodies and four horse-drawn street-watering vans. (See this issue.)

HAMMERSMITH.—February 20th. Electricity Department. Twelve months' supply of stores, including electric light sundries, insulated wire, meters, joint boxes, &c. (See this issue.)

Manchester.—February 12th. Tramways Committee. Permanent-way special trackwork, steel girder tramway rails, copper bonds for tramway rails.

February 19th. Permanent-way points, tongues, crossings, and hardened steel centres; electrodes for welding; and general stores, including electrical items. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Morocco.—February 15th. Municipality of Oudjda. 50-year concession to light the city of Oudjda. The station to be of an initial capacity of 300 kW and capable of being gradually increased. Particulars of Chef des Services Municipaux d'Oudjda.

Norwich.—February 26th. Corporation. Works in connection with Thorpe power station:—Two 24-in. and one 3-in. electrically-driven centrifugal pumps; e.h.p. main switchgear, e.h.p. auxiliary switchgear, l.p. auxiliary switchgear; cable connections, &c.; overhead mono-rail telpher coal conveying plant; four steel-tube fuel economisers, two steel chimneys, and four electrically-driven suction draught fans. (January 25th.)

Plymouth.—February 21st. Electricity Department. Electricity meters, cables (paper insulated), transformers. (See this issue.)

Rhyl.—February 22nd. Electricity Department. L.p. cables. (See this issue.)

Salford.—February 11th. Electricity Department. Coal supplies for six months commencing March 1st, 1924. Particulars and form of tender from Borough Electrical Engineer, Frederick Road, Salford.

Southampton.—February 13th. Board of Guardians. Electric lighting installation, Hollybrook Homes and St. Mary Street Institution. Mr. A. J. Walden, clerk.

Southport. — February 10th. Tramways Department. Overhead electrical equipment of new tramways in Kew Road and Eastbourne Road, Birkdale. (January 25th.)

Warrington.—February 18th. Electricity Department. 12 months' supply of transformers. (February 1st.)

L.p. paper and lead-covered distributing cable. (See this issue.)

Windsor.—February 11th. Board of Guardians. Reconstruction of engineering services at the Institution, with electric lighting wiring and erection of electric motor. Mr. W. W. Nobbs, consulting engineer, 50, Fairhazel Gardens, London, N.W.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—Three Belgian, one Danish, and two German concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of 12 kilometres of 21-conductor telephone cable. The lowest offer was that of Siemens & Halske, of Berlin.

Three Belgian and one each German and English (Callender's Cable & Construction Co.) tenders were received on January 23rd by the Société Nationale des Chemins de Fer Vicinaux, Brussels, for the supply and laying of 4½ kilometres of 750-V d.c. underground electric cable required in connection with the electrification of the Brussels-Espinette-Waterloo local railway. The lowest offer was that of the German concern—the Duisburg Kabelwerk Gesellschaft, of Duisburg.

Bolton.—Education Committee. Additional equipment for the electrical laboratory at Mawdsley Street Technical School.

Tenders from the following firms have been accepted:—Electric Construction Co.; Everett, Edgcumbe & Co.; Cambridge & Paul Instrument Co.; Igranic Electric Co., Ltd.; John Musgrave & Sons, Ltd.

Brighton.—According to the *Brighton Herald*, subject to the sanction of the Electricity Commissioners, the tender of Messrs. Crompton & Co., Ltd., for two 1,500-kW motor-generator sets for the North Road sub-stations, at £10,555, has been accepted. It is essential, in the opinion of Mr. J. Christie, the engineer and manager of the undertaking, that, owing to the rapid growth of the load on the North Road station, one of the sets should be in commission for next winter. Messrs. Crompton undertake to have the first set ready for August 1st. The tenders submitted were as follows:—

Crompton & Co., Ltd. (Accepted.)	**£10,555**
Electric Construction Co., Ltd.	13,788
General Electric Co., Ltd.	15,590
English Electric Co., Ltd.	15,590
Metropolitan-Vickers Electrical Co., Ltd.	15,590
Bruce Peebles & Co., Ltd.	15,590
British Thomson-Houston Co., Ltd.	15,592

The tenders were for a combination of d.c. generators coupled to high-pressure synchronous motors capable of giving 1,500 kW continuous rated output at the terminals of the d.c. generators when running at 500 r.p.m., with 25 per cent. overload for two hours and 50 per cent. momentary overload. Apparently tenderers quoted for their nearest standard designs to comply generally with these conditions.

When the matter came before the Council, says the *Brighton Herald*, Mr. Canter drew attention to the fact that five firms quoted exactly the same price to within £2.

Chelmsford.—Town Council. Accepted:—

Motors and pumps of English make, together with time switches and an underground cable for Boarded Barns Well (£625).—Electric Supply Corporation.

Clacton-on-Sea.—The Urban District Council has placed a contract for a new Diesel engine with the English Electric

Co., Ltd. The plant comprises a 750-b.h.p. Fullagar engine, with a 500-kW generator; the total amount of the contract is £9,671.

Guildford.—Godalming and Woking Joint Hospital Board. Accepted:—

Electric power installation at Woodbridge Hospital Laundry (£130).—Electrical Installations, Ltd.

Keighley.—After full inquiry and after making visits to inspect British and foreign types of plant working in London, the Electricity Committee is understood to have decided to recommend the acceptance of a British tender for the 5,000-kW turbo-alternator, even though a Swiss tender was more than £5,000 below the lowest British offer. The estimated cost of the new set is something like £20,000. The tenders for boilers, estimated to cost about £18,000, will be dealt with at an early date.

Liverpool.—Tramways Committee. Recommended:—

Erection at the Paradise Street sub-station of a 8,000-amp.-hr. battery, with booster and accessories (£61,267).—Tudor Accumulator Co., Ltd.

London.—ADMIRALTY.—Accepted:—

Carbon-filament lamps (part contract).—General Electric Co., Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Three rotary converters, &c., required in connection with the reconstruction of the Elephant and Castle sub-station:—

English Electric Co., Ltd.	£26,392†
Ditto. (Alternative.)	27,068†
Ditto. (Alternative.)	27,655†
Ditto. (Alternative.)	28,364†
Metropolitan-Vickers Electrical Co., Ltd.	27,070†
British Thomson-Houston Co., Ltd.	**27,553**
General Electric Co., Ltd.	27,561
Ditto. (Alternative.)	28,893
Bruce Peebles & Co., Ltd.	27,572

† Does not include spare armature.

The Committee proposes to accept the tender, at £27,553, of the British Thomson-Houston Co., Ltd., this being the lowest complete tender to specification which includes the provision of a spare armature.

Single and double-pole track panels and test panel in connection with the supply of power to the Council's tramways from the Spa Road power station of the Bermondsey Borough Council:—

The Park Royal Engineering Works, Ltd. (Accepted.) ...	**£375**
General Electric Co., Ltd.	512
Johnson & Phillips, Ltd.	522
Bertram Thomas	567
Metropolitan-Vickers Electrical Co., Ltd.	587
Erksine, Heap & Co., Ltd.	704

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 8th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Some Physiological Aspects of Heating and Ventilation," by Mr. K. Gray.

Friday, February 15th. Lecture, "Some Suggestions for Road Transport Development," by Mr. D. S. Capper.

Institution of Welding Engineers.—Tuesday, February 12th. At the Institute of Marine Engineers, Minories, E. At 7 p.m. Paper on "Some Chemical Aspects of Welding," by Mr. J. R. Booer.

Institution of Railway Signal Engineers.—Wednesday, February 13th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6.30 p.m. Annual general meeting and presidential address.

Radio Society of Great Britain.—INFORMAL MEETING.—Wednesday, February 13th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Discussion on "Fine Wire Coils as an Aid to Distortionless Reception," to be opened by Mr. J. H. Reeves.

Institution of Engineers-in-Charge.—Wednesday, February 13th. At St. Bride's Institute, Ludgate Circus, E.C. At 7.30 p.m. Paper on "Electrical Breakdowns and Methods of Prevention," by Mr. E. Mudd.

Institution of Electrical Engineers.—JOINT MEETING WITH THE PHYSICAL SOCIETY OF LONDON.—Thursday, February 14th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Continuation of the discussion on "Loud Speakers for Wireless and other Purposes."

(Scottish Centre).—JOINT MEETING WITH THE MECHANICAL ENGINEERS AND THE LOCOMOTIVE ENGINEERS.—Tuesday, February 12th. At 207, Bath Street, Glasgow. At 7.30 p.m. Lecture on "Railway Electrification in Foreign Countries," by Dr. S. Parker Smith

(North-Eastern Centre).—Tuesday, February 12th. At Newcastle-on-Tyne. Annual dinner.

(Irish Centre).—Thursday, February 14th. At Dublin. Paper on "Printing Press Equipment," by Mr. A. G. Bruty.

(North-Midland Students' Section).—Tuesday, February 12th. At the Technical College, Bradford. At 7 p.m. Address by Major H. Bell, chairman of the North Midland Centre.

Belfast Association of Engineers.—Thursday, February 14th. At the Municipal College of Technology. At 7.30 p.m. Paper on "Superheaters," by Mr. S. Hill.

Royal Institution of Great Britain.—Thursday, February 14th. At 5.15 p.m. At 21, Albemarle Street, W.1. Lecture on "The Crystalline Structure of Organic Substances," by Sir W. Bragg, F.R.S. (Lecture II.)

Edinburgh Electrical Society.—Friday, February 15th. At the Philosophical Institute, 4, Queen Street. At 8 p.m. "Industrial Applications of X-rays," by Mr. R. W. J. Stark.

Manchester Electro-Harmonic Society.—Friday, February 15th. At the Albion Hotel, Piccadilly, Manchester. At 7.30 p.m. Concert.

British Electrical Development Association.—SALESMANSHIP CONFERENCE.—Friday, February 15th. At the London School of Economics, Houghton Street, W.C. At 7.30 p.m. Paper on "How We Placed the First Hundred Cookers," by Mr. R. A. Lower.

Institution of Public Lighting Engineers and Superintendents.—Friday, February 15th. At the Holborn Borough Council Offices, 157, High Holborn, London. At 2 p.m. First conference, and exhibition of street-lighting appliances.

National Association of Supervising Engineers.—Saturday, February 16th. At the Holborn Restaurant. At 6 p.m. Annual dinner and musical evening.

Notes.

"Cosmos" Fire Competition.—The great number of entries received by the Metropolitan-Vickers Co., in connection with its "Cosmos" Fire Competition, has led to some delay in arriving at a final decision, owing to the very careful scrutiny which was necessary in order to arrive at a "short list." The judges (Mr. E. Slater, of the *Electrical Times*, and Mr. E. A. Gatehouse, of the ELECTRICAL REVIEW), arrived at their final conclusions by consideration of such entries as could actually be put into force without serious modification in any advertising campaign decided upon by the company instituting the competition. A number of suggestions, while exceedingly attractive, would involve the expenditure of sums of money which are hardly practicable when it is borne in mind that the article to be advertised is only one item in the multifarious activities of the Metropolitan-Vickers Co.

The judges, bearing these considerations in mind, considered that the entry of Mr. E. R. Morton, of the Sun Electrical Co., could actually be adopted with considerable advantage, and with few (if any) modifications in the scheme as set out. They consider, however, that certain other entries—notably those of Messrs. E. Chappell (who purchased a fire from Messrs. F. Troy, Ltd., 194, Finchley Road, Finchley, N.W.3), and R. M. Bell, electrical engineer, 105, Lloyd Road, Northampton, showed such ingenuity that they would be very glad to see consolation prizes awarded to them, and we understand that the Metropolitan-Vickers Co. has decided to adopt their recommendations. The suggestions of these three gentlemen will undoubtedly be adopted in some degree when further advertising campaigns are considered.

We understand that the 10-h.p. Wolseley car will shortly be delivered to Mr. Morton, and we desire to offer him our congratulations on a very complete and well thought out effort.

Appointments Vacant.—Resident engineer and combustion engineer, for the Colenso power station of the S.A. Railways and Harbours Administration; assistant mains engineer, for the St. Helens Corporation electricity department. (See our advertisement pages to-day.)

Gas and Electricity.—Addressing a gathering of the Midland Junior Gas Association, at the works of the Sutherland Meter Co., Birmingham, Mr. Reginald Clarry, M.P., a director of the company, said that it would be an advantage to the country if gas undertakings could supply electricity as well. It was his intention to take an early opportunity to introduce a Bill into Parliament to make it easier for gas suppliers to do this. Such an arrangement would be of special benefit to small country towns where there was not room for separate undertakings.

Marking Switchboard Busbars and Connections.—The British Engineering Standards Association has issued standards for the marking of switchboard bus-bars and connections (Specification No. 158-1924). This publication contains rules for the colouring and marking of bus-bars and connections, the connection of generators to bus-bars, a description of the points of view of drawings and diagrams (with illustrations), arrangement of bus-bars and connections for three-phase systems, as well as instructions regarding diagrams of switchboard connections. Copies of the publication may be obtained from the B.E.S.A. Publications Dept., 28, Victoria Street, S.W.1, price 1s. 2d., post free.

The Electro-Harmonic Society.—To-night is Ladies' Night at the Electro-Harmonic. The concert will be held in the Caxton Hall, Westminster, commencing at 8 o'clock. Dr. W. H. Eccles, D.Sc., F.R.S., will take the chair, and the artistes will be:—Miss Sophie Rowlands, soprano; Mr. Norman Allin, baritone; Miss Ethel Varick, violin; Miss Dorothy Seacombe, monologues; Mr. Morland Hay, entertainer; Mr. Fred Curtis, humorist; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Submarine Hunting.—On Friday, January 25th, at the Polytechnic, Regent Street, London, Mr. G. H. Nash, C.B.E., gave a popular lecture on "Methods of Submarine Hunting during the Great War." Sir Charles Bright, F.R.S.E., who presided, said the Germans sank 15 million tons of shipping; Mr. Nash came to the rescue with his "fish." The lecturer described the "fish," which was towed astern of a ship at a depth of 40 ft., and detected the presence and position of submarines; it was brought into use in the autumn of 1917, and effected an immediate reduction in the rate of loss of tonnage.

Radio Atmospherics.—In a paper which he recently read before the Wireless Section of the Institution of Electrical Engineers, Mr. E. B. Moullin, M.A., A.M.I.E.E., analysed mathematically the effect of an atmospheric upon a radio receiver. The choice of functions representing the atmospheric has been governed by information contained in the recent Royal Society paper on the "Nature of Atmospherics," by Messrs. R. A. Watson Watt and E. V. Appleton, who used a Western Electric cathode-ray oscillograph, the records showing that the average duration of an atmospheric is about 1/500th second, and that the period of growth usually equals, and is seldom less than half, the time of decay. The average value of the maximum field strength of the atmospherics observed was about 0.1 V per metre, which is about 5,000 times the

field strength of average radio signals. In the past it has been assumed that an atmospheric rises to its maximum in an indefinitely short period of time, and decays at a rate such that it has sensibly died out in a time which is short compared with the duration of a Morse dot (at 25 words per minute a Morse dot lasts about 1/20th second).

Mr. Moullin's mathematical analysis has been made in order to discover if disturbance by atmospherics can be reduced appreciably by suitable design of ordinary receiving circuits. It shows where and when it is advisable to reduce the decrement of a circuit by the use of retro-action; it also shows that an atmospheric is relatively ineffectual in setting up oscillations in the receiver, and so helps to explain why signals have been able to hold their own against atmospherics that are several thousand times as strong. The use of special devices, such as balanced aerials or current limiters, is not considered.

Mr. Moullin's conclusions are that common experience has shown that the difficulty of combating atmospherics is greater than the mathematical analysis contained in his paper would suggest, for to cause great disturbance it seems that atmospherics would have to be at least 10 times as strong as those measured by Watt and Appleton. There are at least two reasons why the analysis makes the problem easier to solve. First, the atmospherics delineated by Watt and Appleton are necessarily single discharges which produce a click in the receiver, but it often happens that a series of discharges occurs in rapid succession, and will cause much more disturbance than a single click. Also, Watt and Appleton observed that high-frequency ripples are often superposed on the main atmospheric, and it is possible that they are the main cause of disturbance. Thus a superposed ripple having one-tenth the amplitude and 10 times the frequency of the main atmospheric will, at least, double the disturbance caused by the discharge. Hence, although it cannot be hoped that the analysis represents the whole problem, it is probably a close approximation to it. The analysis shows that the direct effect of the low-frequency component of current is always negligible, and that the disturbance is caused by the high-frequency oscillation produced by the atmospheric. It also shows that an aperiodic antenna cannot be in itself any protection against atmospherics, and that a tuned loop aerial is more selective than a tuned antenna. For a given wavelength it appears that the disturbance does not depend in any way on the ratio of inductance to capacity, but only on the decrement of the first oscillatory circuit. For audible reception the decrement of the first oscillatory circuit should be reduced until the phenomenon of "ringing" becomes troublesome; the receiver is then in the best condition to battle with atmospherics, and further protection can be obtained only by use of special apparatus, such as current limiters or directional devices.

Electric Heating on Board Ship.—"Some Auxiliary Apparatus for Use on Board Ship" was the subject of an address by Mr. Charles H. Wright, A.M.I.E.E., to the members of the Glasgow University Naval Architecture Society, recently, when he described a new system of heating and ventilating involving separate electrically-operated units for each cabin or compartment, so that complete and independent control of the warming and ventilation was in the hands of the occupant of the cabin. Considerable economies in weight, cost of installation, and energy consumption, he said, were offered by the new system. He also described a new temperature-measuring apparatus for shipboard use and instruments for the analysis of marine boiler uptake gases for CO_2 (carbon dioxide), fixed and portable as well as distant indicating fuel oil tank gauges and their application.

Institution Notes.

Institution of Electrical Engineers.—FARADAY MEDAL.—At the meeting of the Institution on Thursday last week the President, Dr. A. Russell, announced that the Council had that day bestowed the third award of the Faraday Medal upon Dr. S. Z de Ferranti, the pioneer of the transmission of electricity at high pressure.

ANNUAL DINNER.—Members intending to be present at the annual dinner (Thursday, February 21st), who have not yet made application for tickets, are reminded that they should do so as soon as possible.

Institute of Metals.—ANNUAL MEETING.—The annual general meeting of the Institute will be held at the Institution of Mechanical Engineers on March 12th and 13th, commencing each day at 10.30 a.m. The presidential address will be delivered by Prof. T. Turner, M.Sc., A.R.S.M., and no fewer than 14 communications are due for presentation and discussion at the meeting. The annual dinner of the Institute will be held at the Trocadero Restaurant on March 12th. For the first time in the Institute's history the membership passed the 1,500 mark on December 31st, 1923.

Physical Society of London.—ANNUAL MEETING.—The annual general meeting of the Society is being held to-day (February 8th), including the presentation of the Duddell Memorial Medal to Prof. H. L. Callendar, LL.D., D.Sc., F.R.S. Amongst the papers to be read is one on the "Effect of Torsion on the Thermal and Electrical Conductivities of Metals" by J. E. Calthorp.

Institution of Public Lighitng Engineers and Superintendents.—CONFERENCE.—The first conference of this Institution, which was formed in September last, will be held on Friday, February 15th, at 2 p.m., at the Holborn Borough Council Offices, High Holborn, London. A small exhibition of street lighting appliances will be held, and the president, Mr. S. B. Langlands, will deliver an address; afterwards a paper on street lighting will be read by Capt. W. J. Liberty, Public Lighting Superintendent of the City of London. After tea, the centrally suspended electric and gas lamps of the City will be demonstrated, and an inspection of the public lighting of the City and West End will take place.

The subscription for Members or Associate Members is 10s. 6d. per annum.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

MR. W. J. F. FREELAND, chief draughtsman at the Chelmsford works of Messrs. Crompton & Co., Ltd., who has resigned after over 25 years' service in the drawing office, has been presented by the staff with a wireless set, together with a framed photograph of his colleagues.

Kingston-on-Thames Town Council has recommended the Corporation to increase the salary of the Borough Electrical Engineer from £750 to £900 per annum, subject to an agreement that he remains in his position for a period of three years. The Committee also recommends that the salary of the Assistant Engineer be increased by £52 per annum.

MR. COURTENAY N. PRENTICE (son of Mr. Napier Prentice), of the East Anglian Electricity, Ltd., who has been responsible for the electricity supply in Sudbury and Braintree during the last three years, has resigned his position with the company.

MR. JAMES MILNE, who was principal assistant to the general manager of the Great Western Railway, has been appointed assistant general manager.

MR. W. B. DORNAN, chairman of the Ilkley Urban District Council Electricity Committee, was injured in an accident to his motor-car on January 29th.

MR. S. SNAPE, of Sheffield, has been appointed third assistant mains engineer to the Salford Corporation Electricity Department, at a salary of £277 per annum.

MR. J. GRIFFITHS, chief electrician at the Bentley Colliery, near Doncaster, for the past twelve years, has resigned to take up a ten years' appointment under the Indian Government as chief electrical engineer at a central power station at Hyderabad. Mr. Griffiths, whilst at Bentley, has been also consulting electrical engineer to the Urban District Council. He was formerly with the Cannock Chase Collieries, and prior to that an electrician under the Wolverhampton Corporation.

Under the railway grouping scheme, Mr. A. F. ROCK, M.I.E.E., telegraph and electrical superintendent of the old North Staffordshire Railway (which is merged in the L.M. and S. group) has just retired. He entered railway life 52 years ago as a telegraph clerk, and 22 years ago succeeded the late Mr. John Neale as electrical engineer. Nearly all the head office clerks and the drawing staff hitherto controlled by Mr. Rock will be distributed between Derby and Crewe, but a small staff will be retained at Stoke, with Mr. F. T. Scragg in charge of the electric signalling and Mr. H. A. Lewis supervising the electric lighting and power. The telegraph clerks and the commercial side of the department will be left in the charge of Mr. Colin Roberts, Mr. Rock's chief assistant, for the present. For the past eight years Mr. Rock has held the position of hon. secretary to the Railway Electrical and Telegraph Engineers' Conference.

The Lancaster Electricity Committee recommended an increase in the salary of Major G. C. MILNES to £600, but the chairman withdrew it at the Town Council meeting because the Finance Committee is reviewing the salaries of all the principal officials.

SIR JAMES MCKECHNIE, K.B.E., has resigned from the directorate of Vickers, Ltd.

The Stoke-on-Trent Council has been discussing proposals to increase salaries. One recommendation was that the electrical engineer and the surveyor and treasurer, each now receiving salary and bonus amounting to £1,200, be advanced by £50 per annum. Amendments were carried, however, granting all proposed increases of £10 per annum and reducing the amount of all higher advances.

The British Electric Equipment Co., Ltd., has appointed Mr. WM. W. BROWNE as its manager.

Obituary.—MR. J. H. HARGRAVE.—Mr. Joshua H. Hargrave, who has died at Kingstown, Co. Dublin, was a past president of the Institution of Civil Engineers, Ireland.

MR. F. S. DENNISON.—We regret to record the death, which took place on January 31st, of Mr. F. S. Dennison, of the Siemens and English Electric Lamp Co., Ltd., Upper Thames Street, E.C.4. Mr. Dennison was with the General Electric Co., Ltd., for some years, but for over sixteen years he had been associated with Messrs. Siemens, latterly as one of their chief assistants in the Lamp Department. He is sadly missed by all his colleagues.

Will.—The late Sir ANDREW BEATTIE, who was connected with various electric lighting and tramway companies in the United Kingdom, left £9,999.

New Companies Registered.

Reflexlite, Ltd. (195,283).—Private company. Registered January 24th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of electrical and other advertisement signs, advertising contractors, glass manufacturers, printers, electric light fitters, &c. The subscribers (each with one share) are:—A. M. Everett, 29, Osney Crescent, N.W., merchant; F. C. Owlett, 82, West Hill, Sydenham, S.E.26, advertising agent. Qualification (except first directors or directors appointed by them), £100. Remuneration as fixed by the company. Registered office: 34, Surrey Street, Strand, W.C.2.

Normond Lift Co., Ltd. (195,265).—Private company. Registered January 24th. Capital, £250 in £1 shares. To carry on in the U.K. and elsewhere the business of makers and repairers of electric and hydraulic lifts and cranes, general engineers, &c. The first directors are:—H. Byford, 67, Mayola Road, Clapton, E.5, engineer (chairman); P. Saunders, 21, Rathcoole Gardens, Hornsey, N.8, engineer; N. A. Taylor, 49, Archway Road, Highgate, N.19, engineer. Remuneration as fixed by the company. Secretary, N. A. Taylor. Registered office: Cromwell House, High Holborn, W.C.

Phœnix Dynamo Manufacturing Co., Ltd. (195,266).—Private company. Registered January 24th. Capital, £100 in £1 shares. To carry on the business as indicated by the title. The subscribers (each with one share) are:—P. J. Pybus, 21, Whitehall Court, S.W.1, engineer; E. D. Johnson, 12, Briardale Gardens, Hampstead, N.W.3, C.A. The first directors are to be appointed by the subscribers. No qualification required. Registered office: Queen's House, Kingsway, W.C.

Atmos Electrical Co., Ltd. (195,257).—Private company. Registered January 24th. Capital, £2,000 in £1 shares (1,000 6 per cent. non-cumulative preference and 1,000 ordinary). To take over the stock in trade, furniture, fixtures, plant, machinery, and other assets (except book debts) of the business of electrical and general factors and merchants carried on by E. Sharpe and A. Poole as the "Atmos" Advertising Co., Nottingham. The subscribers (each with one ordinary share) are:—H. Darnborough, 315, Hucknall Road, Nottingham, engineer; A. Pool, 1, Wildman Street, Nottingham, contractor. The first directors are not named. Qualification, 100 shares. Secretary: H. Darnborough. Registered office: 32, Goldsmith Chambers, Goldsmith Street, Nottingham.

N.S. Plating Co., Ltd. (195,281).—Private company. Registered January 24th. Capital, £100 in 1s. shares. To carry on the business of electrical engineers, nickel, silver and zinc platers of metals, bronzers, enamellers and gilders, manufacturing chemists, &c. The first directors are: J. Keefe, 111, Queen's Road, Buckhurst Hill, Essex, director of companies; H. M. J. Keefe, Eastney, Buckhurst Hill, Essex, journalist. Qualification (except first directors, who require none) 1 share. Registered office: 86b, South End, Croydon.

Reliance Electrical Supplies, Ltd. (195,314).—Private company. Registered January 25th. Capital, £3,000 in £1 shares (300 ordinary and 2,700 10 per cent. participating preference). To acquire the business as now carried on by S. Falk and E. Stokes, electrical contractors and sign makers, of 18, Baxtergate, Doncaster. The first directors are:—S. Falk, 43, Osborne Road, Newcastle-on-Tyne; E. Stokes, 12, Osborne Road, Doncaster. The said E. Stokes shall be permanent managing director with £300 per annum (free of income tax) as remuneration, in addition to his director's fees. Qualification, 25 shares. Remuneration, £25 each per annum (chairman, £50). Registered office: 18, Baxtergate, Doncaster.

Dentx, Ltd. (195,325).—Private company. Registered January 25th. Capital, £2,700 in £1 shares (2,500 8 per cent. cumulative preference, 100 ordinary and 100 founders'). To carry on the business of radiography in all its branches, including the manufacture, purchase and sale of radiographic apparatus and dental and medical radiography, &c. The subscribers are:—S. G. Gliksten, 40, Park Lane, W., gentleman, 1,000 preference shares; S. C. Tee, 50, Moorgate, E.C., architect and surveyor, 500 preference shares. The first directors are: D. T. King, S. C. Tee and V. G. Willems (all permanent, subject to each holding 10 shares). Qualification, £10 shares. Remuneration, £100 each per annum. Secretary: D. T. King, Richmond Hill, Surrey. Registered office: 14, Hanover Square, W.

Wireless Valves, Ltd. (195,321).—Private company. Registered January 25th. Capital, £2,500 in £1 shares. To carry on the business of manufacturers of and dealers in wireless apparatus and accessories and appliances, &c. The subscribers (each with one share) are:—J. R. Pakeman, 11, Ironmonger Lane, E.C., solicitor; G. Rowson, 11, Ironmonger Lane, E.C., solicitor's clerk. The subscribers are to appoint the first directors. Qualification, 50 shares. Solicitors: Pakeman, Son and Read, 11, Ironmonger Lane, E.C.2.

Hircalite Moulded Compositions, Ltd. (195,336).—Private company. Registered January 26th. Capital, £5,000 in 3,000 shares of £1 and 8,000 shares of 5s. To carry on the business of manufacturers of all classes of moulded articles for electrical and other purposes, &c. The subscribers (each with one ordinary share) are:—H. L. Foden-Pattinson, 141, Bedford Court Mansions, Bloomsbury, W.C.1, articled clerk; S. W. Batson, 16, Richmond Road, East Finchley, N.2, clerk. The subscribers are to appoint the first directors. No qualification required. Remuneration, £300 each per annum, free of income tax. Secretary: S. W. Batson. Registered office: Kintore Works, Grange Road, Bermondsey, S.E.

Elba, Ltd. (195,376).—Private company. Registered January 29th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of electrical batteries, accumulators, dry cells for bells and telephones, electrical pocket lamp cases, lighters and electric novelties, &c. The subscribers (each with one share) are:—H. W. Mortlock, 102, Astonville Street, S.W.18, secretary; R. C. Chamberlain, 40, Landseer Road, Holloway, N.19, clerk. The first directors are not named. Qualification, £1. Remuneration as fixed by the company. Secretary: H. W. Mortlock. Registered office: 1, Winchester Place, Acton, W.

Speedex, Ltd. (195,393).—Private company. Registered January 29th. Capital, £2,500 in £1 shares. To carry on the business of electrical, mechanical and motor engineers, toolmakers, machinists, stampers, piercers, diesinkers, electricians, fitters, millwrights, metal workers and hardware manufacturers, &c. The subscribers (each with one share) are:—B. O. Morris, The Woodlands, Tyburn Lane, Shirley, engineer; C. A. Hardy, 21, Haden Hill, Wolverhampton, cashier. B. O. Morris signs documents as director. Qualification, 1 share. Remuneration as fixed by the company. Registered office: 2, Lancaster Street, Birmingham.

Official Returns of Electrical Companies.

Whitstable Electric Co., Ltd.—Issue on January 4th, 1924, of £1,000 debentures, part of a series already registered.

Hindhead and District Electric Light Co., Ltd.—Issue on January 15th, 1924, of £50 debentures, part of a series already registered.

Eclat Electric Manufacturing Co., Ltd.—Particulars filed of £13,500 second debentures authorised January 7th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, subject to the existing first mortgage debentures for £6,000, the whole amount being now issued.

Eclat Electrical Accessories (Paddington) Co., Ltd.—Particulars filed of £1,600 debentures authorised January 16th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Dodd & Oulton, Ltd.—Satisfaction in full on January 19th, 1924, of mortgage dated June 15th, 1920, securing £10,000 and interest.

V. G. Middleton & Co., Ltd.—Satisfaction to the further extent of £600 on December 31st, 1923, of debentures dated April 29th, 1920, securing £4,000.

Barford Electric Supply Co., Ltd.—Satisfaction in full on January 22nd, 1924, of debenture dated August 11th, 1916, securing £700.

Holborn Radio Co., Ltd.—A. V. Jones, of 30, Elm Grove, Crouch Hill, N.8, ceased to act as receiver and manager on January 12th, 1924.

British Gramophone and Wireless Co., Ltd.—J. C. Pidgeon, of 6, Old Jewry, E.C., was appointed receiver on January 22nd, 1924, under powers contained in debentures dated October 22nd, 1923.

G. Weston & Sons, Ltd.—F. S. Wilks, of 31, Lombard Street, E.C.3, ceased to act as receiver or manager on January 28th, 1924.

H. Haydon & Co., Ltd.—F. T. Birch, of 27½, Friar Lane, Leicester, was appointed receiver on January 23rd, 1924, under powers contained in debentures dated August 1st, 1923.

J. H. McBean, Ltd.—H. Appleyard, of Barclays Bank Chambers, Dewsbury, ceased to act as receiver or manager on January 11th, 1924.

Kalgoorlie Electric Tramways, Ltd. (73,127).—Return dated August 8th, 1923. Capital, £250,000 in £1 shares. All shares taken up. £250,000 paid. Mortgages and charges, £139,405.

Wardle Engineering Co., Ltd. (102,714).—Return dated November 15th, 1923. Capital, £7,000 in 5,000 ordinary and 2,000 preference shares of £1 each. All shares taken up. £6,800 paid. £200 considered as paid. Mortgages and charges, £4,000.

Armature Repairing and Supply Co., Ltd.—A. O. John, of Temple Street, Swansea, ceased to act as receiver and manager on January 22nd, 1924.

City Notes.

Lanarkshire Tramways Co.

The report which was submitted at yesterday's meeting of the company showed that the revenue earned during the year ended December 31st last increased by £7,618 to £202,905. Expenses at £150,074 were lower by £2,743. From the balance of £52,831 the following expenses were met: Contributions to local authorities, £4,839; income tax, £133; debenture interest, £636; interest account, £3,888; transfer to reserve for depreciation, £15,000. This left a balance of £28,334, to which was added a sum of £1,801 brought forward, making £30,135. This has been disposed of as follows: Interim dividend at the rate of 7 per cent. on the issued share capital for half-year ended June 30th, 1923, £13,081; dividend at the rate of 7½ per cent. for the latter half-year, £14,016; and the balance, £3,038, has been carried forward, subject to additional remuneration to the directors.

Aron Electricity Meter, Ltd.

Owing principally to the receipt of £206,000 from the British Clearing Office for Enemy Debts, the directors are able to announce a payment of 36 per cent., less tax, for the nine years ended March 31st last. A dividend of 6 per cent. from the profits of the current year on account of arrears on the 6 per cent. cumulative preference shares is also announced; this brings payment up to March 31st, 1921. This is the first dividend announcement since 1914.

The directors state that they have purchased £23,500 5 per cent. first mortgage (convertible) debentures at the price of £100 plus accrued interest, and they make an offer to the holders of outstanding debentures on the same terms. Those desirous of accepting the offer are asked to communicate with the trustees, the Consolidated Trust, Ltd., 9, New Broad Street, E.C.2.

Melbourne Electric Supply Co., Ltd.

A Melbourne Exchange dispatch dated February 1st, says:—"The Electric Supply Co.'s franchise expires at the end of next year, and the Victoria Government is offering to grant a ten years' extension, provided that dividends are limited to 7 per cent. on the ordinary shares and 8 per cent. on the preference. Excess profits must be utilised to reduce charges to the consumer. The Government retains an option for acquiring the assets of the company at the end of five or seven and a-half years. The company cannot issue further shares or debentures without the Government's approval. The acquisition is based upon the original actual cost, less 3 per cent. depreciation for each year. The Government is to submit the proposal to Parliament and the directors will consult the shareholders."

Fife Tramway Light & Power Co.

The trading profits of the undertakings operated by this company were £121,703 for 1923. After meeting debenture, preference and other charges, a dividend on the ordinary shares at the rate of 8 per cent. per annum less tax is recommended, carrying forward £3,675. The *Financier* states that the increased demand for consumers necessitated duplication of certain of the company's high-pressure mains, portions of which are in course of construction, and in contemplation the redemption of the 7 per cent. Debenture stock at the earliest favourable date, but this will only be effected provided satisfactory arrangements can be made for the necessary capital issue.

Italian Companies.—The following companies have decided to increase their capital:—Società Anonima Distribuzione Energia (Milan), from 264,000 to 1,000,000 lire; Società Italiana Apparrechi Protezione Impianti Elettrici Interni (Milan), from 40,000 to 500,000 lire; Unione Esercizi Elettrici (Milan), from 80,000,000 to 102,000,000 lire; Società Anonima per le Forze Idrauliche di Trezo d'Adda "Benigno Crespi," from 20,000,000 to 30,000,000 lire; Società Idroelettrica Cisalpina (Milan), from 30,000,000 to 45,000,000 lire, the increased capital being needed to complete the plant on the Liro at Chavenna; Fabbriche Electrotechniche Riunite (Milan), from 40,000 to 3,000,000 lire; Società Anonima Luce e Forza (Parabiago), from 1,000,000 to 2,000,000 lire; and the Società Imprese Elettriche Sarde (Cagliari), to 600,000 lire.

Metropolitan Railway Co.—It is proposed to pay a dividend at the rate of 5 per cent. per annum for the past half-year (making 4 per cent. for the year), to place £15,000 to general reserve, and to carry forward £35,000. A dividend of 3½ per cent. was paid in the previous year, the same amount was put to reserve, and £33,137 was carried forward. A dividend at the rate of 3½ per cent. is to be paid on the Surplus Lands stock, as against 3¼ per cent. for the latter half of 1922; £1,000 is placed to reserve; and £1,732 is carried forward. In 1922 £2,000 was put to reserve, and £2,563 carried forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Kensington and Knightsbridge and Notting Hill Electric Lighting.—£100,000 5½ per cent. debentures, 1926, fully-paid scrip.

Metropolitan Trust Co.—20,000 new shares of £10 each, issued at £16 per share, partly paid and fully paid, Nos. 20,001 to 40,000.

English Electric Co.—1,234 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 982,332 to 983,565), and £230 6 per cent. convertible debenture stock.

Marconi's Wireless Telegraph Co.—65 ordinary shares of £1 each, fully paid (Nos. 3,000,601 to 3,000,065).

Electrical and Industrial Investment Co., Ltd.—The revenue account for 1923 shows a profit of £14,807, plus £5,896 brought forward. After paying 6 per cent. on the cumulative preference shares, 7 per cent. on the preferred ordinary, and 15 per cent. on the deferred ordinary shares, £7,029 is to be carried forward subject to corporation profits tax.

Westminster Electric Supply Corporation, Ltd.—A final dividend of 7s. 6d. and a bonus of 3s. per share is recommended, making 15 per cent. for the past year. This compares with payments of 12 per cent. in the preceding year, and 10 per cent. in 1919, 1920, and 1921. Lighting rates are to be reduced by ½d. per kWh, and power and heating rates by ¼d. per kWh.

City of Buenos Ayres Tramways (1904), Ltd.—A balance dividend of 1s. 3d. per share, less tax (making 5 per cent. for the year ended December 31st last) is recommended. It is proposed to transfer £5,000 to the general amortisation fund, and to carry forward £9,463. The figures are practically the same as those of the preceding year.

Clontarf and Hill of Howth Tramroad Co.—Balance dividend at the rate of 3 per cent. recommended, making 3 per cent. for the year as in 1922.

Hart Accumulator Co., Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares for 1923.

Belgian Company.—The *Compagnie Belge d'Exploitations Electriques* has raised its capital from 500,000 to 1,050,000 fr.

Traction & Power Securities Co., Ltd.—The annual meeting was held on Monday. Our report will appear next week.

St. James' & Pall Mall Electric Light Co., Ltd.—Further dividend for 1923 of 7s. 6d. per share on the ordinary shares, with a bonus of 5s. per share, making a total of 17½ per cent. for the year, against 14½ per cent. for 1922.

Smithfield Markets Electric Supply Co., Ltd.—Final dividend at the rate of 5 per cent. for the half-year, making 8 per cent. for the year, against 6 per cent. for 1922.

Power Securities Co., Ltd.—A meeting of this company was held on Tuesday too late for inclusion in our editorial pages this week.

Stocks and Shares.

MONDAY EVENING.

STOCK EXCHANGE markets maintain their robust strength, and the greater number of movements which have occurred since we last wrote have curved in the upward direction. This has applied equally to investment and speculative issues. Moreover, the public are showing a more ready willingness to take new stock, and borrowers are quick to notice this alteration in sentiment, with the result that a number of new issues are known to be on the point of flotation. The unexpectedly sound character of the Cabinet, and the rather better tendency prevailing in the atmosphere of Continental politics are the two main factors in the situation. The settlement of the railway strike, so rapidly followed by fears of fresh outbreaks in the transport and dockers' trades, is scarcely considered. People are insistent upon purchases of Home Railway stocks; and, indeed, of all other investment securities.

The declaration of the Metropolitan's expected dividend, making 4 per cent. for the year, caused an abrupt break in the price from 76½ to 74¾, but the effect of the profit-taking which brought this about was partially wiped out by an accession of new buyers, and the price recovered to 75½. The District is expected to make its announcement on the Thursday in this week, and probably on the same day the other electric railway companies will publish their results for last year. In the expectation of these being good, the market is very firm. So far as the District itself is concerned, the expectation that has prevailed for several months past, and has been repeated here on many occasions, is that the company will declare a dividend making 3½ per cent. for 1923, and show in its report that it could distribute substantially more if profits were to be divided more nearly up to the hilt. Districts are 1½ higher, and the Underground varieties have further advanced.

Electricity supply shares have been strengthened by the declaration of a bonus of 3 per cent. on top of the Westminster's previous 12 per cent. dividend, this making 15 per cent. for the year. The announcement was unexpectedly good, and Westminsters have risen 17/6 to 10¼. The declaration had a strengthening influence over other London shares. Brompton, Charing Cross, City & County, Kensington, London, Metropolitan, St. James & South London ordinary show a healthy catalogue of advances.

The London County Council Special Committee on London Electricity Supply refers to a difficulty that has arisen through the existence of special rights of perpetual supply now possessed by some of the power companies. The reference arises out of the Council's report on four important Bills before the Council which deal with electricity supply in London, and two of the bills to which the Council takes objection on this ground are those promoted by the County of London and the North Metropolitan Electric companies.

Shares in the manufacturing concerns are better, mainly by reason of the Aron Meter Company's announcement of a 42 per cent. dividend on its preference shares. This represents seven years' dividends, and leaves arrears, still to be met, from April 1st, 1921. Upon this news, the price of the preference rose to 22s. 6d., and the ordinary to 9s. 3d. For some time past, a substantial dividend on account of preference arrears had been talked of, but the confirmation of these hopes is none the less pleasant or gratifying. It is hoped that the Aron Meter will have no great difficulty in clearing off the three years' dividend that will become due in respect of the period ending with March 31st next.

Rises have occurred in General Electrics, Edisons and English Electrics. The telegraph manufacturing shares follow the same trend, with recoveries in British Insulated, India Rubber, and Telegraph Constructions. Babcock & Wilcox have gained a small fraction. Iron, steel and armament shares are generally firmer in price.

Further material rallies in the cable group lifted Eastern ordinary to 170½ (which makes a rise of 13 points within a fortnight), Eastern Extensions are £1 higher on the week, while Western Telegraphs and Globes are ½ better. There is hardly any stock to be had with which to satisfy the now eager buyers. Anglo-American Telegraph preferred is 1½ up. United River Plates have recovered to 6⅞ now that the sellers of the rights are nearly through with their profit-taking. Wireless issues, with Marconis 1/16 higher at 38s. 9d., are better, though Radio common remain dullish after their recent jump. "Dollar" stocks suffered in this week's decline in the value of American currency as compared with the £. Kaministiquia shares are lower at 12½. Rio Tramway and Sao Paulo Tramway 5 per cent. first mortgage bonds went back to the common price of 98.

Brazilian Tractions continue to forge steadily ahead. Mexicans are weaker; reports concerning the progress of the so-called revolution are contradictory. A flutter of excitement was caused by a sudden rise of 2s. 9d. in London and Suburban Traction preference, the price running up to 8s. 9d. for reasons that have yet to be made apparent. The dividend declaration is, of course, due to be made this month. The previous protracted weakness in the price of the shares was held by some to be a discounting of possible disappointment in connection with this dividend. There are still several years' arrears to be met of dividends due in the past, and not yet paid off. The Melbourne Electric Supply Company repeats its usual excellent dividend of 10 per cent., tax free, and the report shows an increase of £74,000 in the trading profit for last year.

Rubber shares remain inanimate, but the tone of the market is slightly harder in sympathy with the tendency of the Stock Exchange as a whole.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1921.	Dividend. 1922.	Price Feb. 4, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	12	2	+2/-	£6 0 0
Charing Cross Ordinary	5	9	14½	14½	+ ½	5 2 7
do. do. do. 4½ Pref.	5	4½	4½	4⅞	—	5 7 5
Chelsea	1	6	10	35/-	—	5 14 3
City of London	1	14	15	2⅜	+ ⅛	6 6 4
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
County of London	1	8	10	2⅛	+ 1/16	4 14 1
do. do. 6 % Pref.	1	6	6	22/6	+6d.	5 6 8
Edmundson's Ordinary	5	Nil	7	3½	—	5 12 0
do. 6 % Pref	5	12/-	6	4⅜	—	6 3 0
Kensington Ordinary		10	12	10½	+ ½	5 14 3
London Electric	5	4	10	5½	+ ¼	5 18 0
do. do. 6 % Pref.	5	6	6	5½	—	5 9 1
Metropolitan	1	7	8½	1⅞	+ ⅛	4 17 2
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary	1	Nil	2½	16/3	—	3 1 6
do. 5 % Pref.	1	5	5	15/6	—	6 9 0
do. 7 % Pref.	1	7	7	22/6	—	6 4 5
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref.	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	17/3	—	Nil
do. 6 % Pref.	1	2½	5	17/6	—	6 17 2
St. James' and Pall Mall	5	12	14½	12	+ ½	6 0 10
South London	1	7	10	39/3	+3/-	5 2 0
South Metropolitan Pref.	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10⅞	+ ⅛	6 0 0
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 8 2

Home Rails.

Central London Ord. Assented	Stock	4	4	7⅛	—	5 12 0
Metropolitan	,,	2½	3½	75½	−1	5 6 0
do. District	,,	1	3	57	+1½	5 5 3
Underground Electric Ordinary	10	Nil	Nil	2½	+ ¼	Nil
do. do. "A"	1	Nil	Nil	8/6	—	Nil
do. do. Income Bonds	4	5	10s		+1	*5 16 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	+1½	5 16 0
do. Def.	,,	1½	34/6	22½	—	6 13 4
Chile Telephone	5	6	6	5⅞	—	5 2 2
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17	+1	5 17 8
Eastern Tel. Ord.	Stock	10	10	170½	+5	5 17 4
Globe Tel. and T. Ord.	10	10	10	17⅛	+ ⅜	5 16 9
do. do. Pref.	10	6	6	11	+ ¼	5 9 1
Great Northern Tel.	10	24	22	28½	—	7 16 0
Indo-European	25	10	7	23½	—	*5 7 8
Marconi	1	25	15	1⅝	+ 1/16	7 14 8
Oriental Telephone Ord.	1	12	12	1⅝	—	*8 8 0
United R. Plate Tel.	5	8	8	6⅜	+ ⅛	*6 0 9
West India and Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16⅜	+ ⅜	*6 0 4

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	6½	13½	2⅛	—	9 7 2
do. do. 2nd Pref.	5	Nil	5½	2⅛	—	9 15 6
do. do. 5% Deb.	Stock	5	5	74	—	6 15 2
British Electric Traction Ord.	,,	4½	5	68	+1	7 7 3
do. do. 6% Pref.	,,	6	6	98½	—	6 1 10
Brazil Traction	100	Nil	4	53½	+ ½	7 9 7
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	5	9d.	87½	—	*5 10 6
do. do. Deferred	,,	5	12/1-	103½	—	*6 4 9
do. do. Deb.	,,	4½	4½	79½	—	5 7 0
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	8/9	+2/9	11 8 6
London United Tram. Deb.	Stock	4	4	56	—	7 2 10
Mexico Trams. 5 % Bonds	—	Nil	Nil	67½	−1	7 8 0
do. 6 % Bonds	—	Nil	Nil	48½	−2	Nil
Mexican Light Common	100	Nil	Nil	18	—	Nil
do. Pref.	100	Nil	Nil	44½	—	Nil
do. 1st Bonds	—	Nil	5	62½	−1	8 1 0

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2⅝	+ 1/16	*4 8 0
British Aluminium Ord.	1	10	5	1⅛	—	4 14 1
British Insulated Ord.	1	15	15	2⅜	—	6 6 4
Callenders	1	15	15	2⅛	+ 1/16	6 3 0
do. 6½ Pref.	1	6½	6½	24/3	—	5 7 2
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	4/-	10	Nil	4/6	+6d.	6 13 4
do. do. 5% Deb.	Stock	5	5	72½	+2	6 18 0
Electric Construction	1	10	10	20/6	—	6 15 7
English Electric	1	5	5	17/6	+6d.	5 14 3
do. do. Pref.	1	6	6	1	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	22/6	+6d.	5 15 7
do. Ord.	1	10	5	19/9	+6d.	5 1 3
Henley	1	15	15	2⅛	− 1/16	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	10	—	½	+ 1/16	*7. 5 6
Met.-Vickers Pref.	3	8	8	2⅜	—	6 8 0
Siemens Ord.	1	10	10	15/9	—	Nil
Telegraph Con.	13	20	20	23½	+ ½	*5 2 2

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Feb. 5.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£62	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£35	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £120	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£235	£16 inc.
Grade II ... ... ,, ,,	£167	£11 inc.
Grade III... ... ... ,, ,,	£91	£5 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9¼d.	½d. inc.
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ... ... ,,	10½d.	½d. inc.
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton	£95	£2 inc.
c ,, Sheet ... ... ,,	£95	£2 inc.
c ,, Rod ... ... ,,	£95	£2 inc.
d ,, (Electrolytic) Bars ... ,,	£66	35/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£76	25/- dec.
d ,, ,, H.C. Wire per lb.	9⅞d.	½d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/6	...
h India-rubber, Para fine ... ,,	1/0½	½d. dec.
Iron Pig (Cleveland Warrants) ... per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£35	...
g Lead, English Pig ... ... ,,	£34	10/- inc.
g Mercury ... ... per bot.	£9 15s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/9	...
p ,, drawn bars and rods ,,	1/8½	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£35	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£257 to £258 15s.	£5 to £7 5s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

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Blinded Soldiers as Telephone Operators.—It may not be generally known that one of the most successful occupations taught to the blinded soldiers at St. Dunstan's is telephone operating. A large number of these men have found employment with important business firms and organisations in London and the Provinces, and not a few employers state that their board has never been so well and efficiently managed as by their blinded soldier operator. We have seen some of these testimonials, and they are certainly very satisfactory. This may be because the freedom from outward distraction—a natural accompaniment of blindness—enables the blind operator to concentrate on his work to a much higher degree than is possible in the case of a sighted operator, and thus he can maintain an excellent service. St. Dunstan's has several fully-trained men ready for work. There may be some readers extending their premises, or faced with a necessary change in their present arrangements, who might like to give a St. Dunstan's operator a trial. If so, the authorities at St. Dunstan's Headquarters, Inner Circle, Regent's Park, N.W.1, will gladly supply full particulars. A point to bear in mind is that the employer's liability for his blinded soldier operator is no more than in the case of any ordinary employé. To his employer he is a perfectly normal member of the staff. His special needs as a blinded ex-Service man are the permanent and sole responsibility of St. Dunstan's After-care Organisation.

Funereal Advertising.—The *Electrical News*, in a recent issue, reproduced a photograph of an electrical dealer's shop-window. The central "attraction" was a tombstone bearing the words: "Here lies the wife of Hiram Green. He would not buy her a washing machine, but when over the tub her life was spent, he hastened to buy a monument." As our contemporary, in commending the display, justly remarks: "With a little ingenuity you can get up many sure-fire crowd-stoppers with simple materials."

Some Researches on the Safe Use of Electricity in Coal Mines.

By Prof. W. M. THORNTON, O.B.E., D.Sc., D.Eng., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRICITY is the perfect medium for conveying energy underground; its advantages are clear, but it has its limits—the possibility of leakage and the electric spark. The limiting electrical conditions under which ignition of coal dust and firedamp may occur have been worked at in the author's laboratory for the past 14 years, as part of a general investigation of the mechanism of the ignition of gases. The paper contains an account of some results of practical interest, and shows how far from the truth is the old idea that every visible spark will fire an explosive gaseous mixture; it also defines the limits within which the safe use of electricity is possible for the various purposes of mining.

There is, if the human element of carelessness could be for ever removed, for each possibility of electrical risk a simple and effective preventive.

The inflammable part of pit gas in this country is methane (CH_4), the lowest and most inert of the paraffin series of compounds. It is to this inertness that coal-mining owes the greater part of its immunity from explosions. Most of the accidents in mines are mechanical in origin, and are due to the poor illumination on haulages, or to the difficulty of keeping earth movements under continual observation. Safety in coal mines, now and in the future, depends on efficient ventilation (already excellent), the elimination of all sources of flame or open sparking, the improvement of underground illumination, not so much at the face as along the roads, and on the training into habits of constant observation and carefulness of those upon whom the getting of coal depends.

Only 11 per cent. of the coal raised in England and Wales is cut by electrical machines. Scotland alone cuts 36 per cent. mechanically; but it is in electrical haulage that development is likely to be greatest.

Coal dust is present everywhere throughout the workings, and all the great disasters have been dust explosions, ignited in most cases by a small gas explosion.

Methane is inflammable between 5.6 and 14.8 per cent. of air. In mixtures, both weaker and richer, there may be burning around the source of ignition, but there is no sustained explosion wave or marked rise of pressure. In the case of coal dust there is a wide variation in the mass of dust required to transmit an explosion, but the cloud must always be dense. It depends in the first place on the fineness of the dust and on the ratio of the combustible to the non-combustible components. If 50 per cent. of stone dust is added, it usually, though not with every kind of coal dust, prevents the transmission of flame. With any dense cloud of dust the presence of 2 per cent. of gas makes a coal-dust explosion inevitable.

Coal dust can be ignited without the presence of gas by blown-out shots and by electric flashes, provided that there is a dense cloud formed before the arc is struck. Single electric arcs can fire coal dust, and fig. 1 shows that such ignition is well within possibility, though the risk is remote in modern practice. Ignition by alternating-current arcs is more difficult than by direct current. At 1,000 volts they are much the same on account of the longer arcs at peak.

Ignition of coal dust by single condenser discharge sparks has not so far been obtained; nor does it appear probable, for dust ignition is by a process of disintegration and combustion under the influence of heat, and for this a longer time is necessary than the duration of a condenser discharge. There are many conditions of mining which give rise to static discharge in dry atmospheres, but I have never succeeded in lighting a stream of gas by the long, thin sparks from a belt. Another very active source of electrification is the formation of dust clouds, and it is conceivable that it may help the transmission of flame, though from experiments that I have made, an external electric field has no measurable influence on a gas explosion.

A phenomenon of regular occurrence is the production of long, powerful sparks at the nozzle of an hydraulic jet filling cement grout into stone packing. This is an example of electrification produced by splashing, and the electrification is conducted back through the liquid to the nozzle and the spiral wire support of the rubber feeding tube. The remedy is to earth the wiring of the supply pipe. In this case also it is unlikely that ignition of firedamp would occur. The activity *per unit length* of the spark is insufficient to start self-ignition of the gas.

Occasional reports are received from coal-cutter operators that a blue flame has been seen to flash around the back of the cut. This may possibly be ignition of minute blowers of gas by hot particles or spots on the cutter tools. It has nothing to do with the electricity supplied to the machine.

A possible source of ignition is electrification by crushing or shear of rock faces, a well-known phenomenon in splitting crystals, which has been observed on a large scale underground when masses of stone are brought down, but it is extremely difficult to fire pit gas in this way experimentally. Trials on a larger scale than are possible in a laboratory are necessary to prove electrification by splitting to be a possible source of ignition.

Sparks occasionally pass between the rotor and stator of induction motors in belt-driven haulages. By their appearance they are static discharges, and are caused either by surges on the high-pressure system, in which case a spark would be followed by a "power current," and this is never observed, or by an electrostatic charge from the belt passing by the shaft to the rotor and escaping by discharge across the narrow air-gap rather than by breaking down the oil film of the bearings. To prevent this, the rotor, as well as the stator frame, must be earthed. It is not very likely that these sparks would fire gas, but such machines are not now placed where 6 per cent. of gas can accumulate, and would be totally enclosed and flame-proof for use inbye.

A short spark having an energy of 0.03 joule will just ignite pit gas, which indicates that it is not the total energy which is important, but the energy per unit length of the spark, in so far as it is a question of energy as distinct from "activation" of the gas by the voltage gradient.

The voltage across the break is therefore the most important feature of an arc as a source of activation of the gas in which it is formed. On this view it was only necessary to suppress the inductance voltage at a break in order to

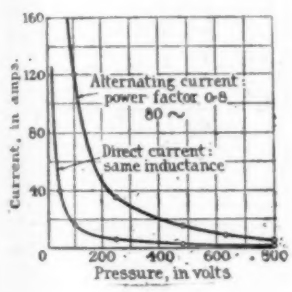

FIG. 1.

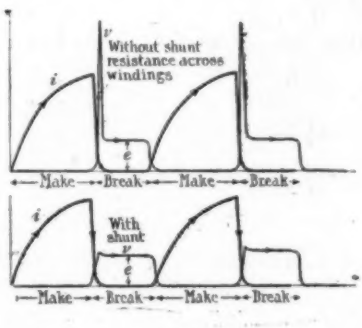

FIG. 2.

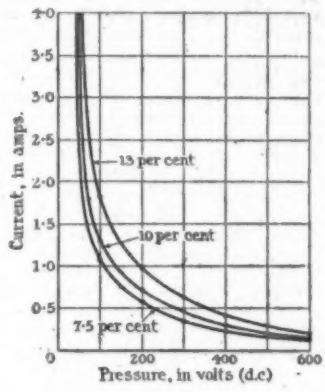

FIG. 3.

Fig. 1.—Least Currents for Ignition of Coal Dust by Transient Arcs.

Fig. 2.—Oscillograms of Signalling-bell Currents, and Voltage across Trembler Contact.

Fig. 3.—Least Igniting Currents of Methane-air Mixtures by Transient Arcs.

minimise the risk of ignition from a bell, and the direct way to do this is to connect across the ends of the magnet winding a non-inductive resistance of value sufficiently low to act as an efficient shunt, but as high as possible to lessen the demand on the signalling battery while the bell is in action. The magnitude of this depends on the inductance of the windings, but resistances as high as 20 times that of the coils were on occasion effective. Between 10 and 20 times is usual.

So long as the pressure across the trembler contact does not exceed about 25 volts, a bell can be made to ring freely in the most explosive mixture of illuminating gas and air—much more sensitive to ignition than firedamp—without igniting it. Pressures of 150 volts across the trembler break are not unusual in an ordinary 2-volt bell. Unless the inductance voltage is suppressed, a bell becomes a miniature magneto so far as regards its power of ignition. The oscillograms of fig. 2 show how the voltage is suppressed by shunting the bell magnet windings.

Modern d.c. bells can be specified so that inflammable gas shall not be ignited by the spark at the trembler contact, but the spark of a.c. bells at the signalling point where the circuit is made and broken is dangerous. It can be suppressed by arranging a high resistance across the wires so that it is brought into action by a double contact when the signal is made.

A common method of testing whether a hand a.c. generator is in good working order before a shot is fired, is to touch the ends of the leads together and observe the nature of the spark. Four out of five of such machines will ignite a 9.5 per cent. mixture of methane and air, generally after many trials. Since, however, before a shot is fired the place must be declared free from gas, the risk of testing the circuit by open sparking is less dangerous than the risk of having uncertain shot-firing. A small closed tube with a flexible make-and-break contact inside is a safe means of examining the spark.

Electric lighting in coal mines is passing through two phases: the displacement of the portable oil lamp and the improvement of general lighting, not only at shaft landings, but also along the roads. The economic value of the former change is now recognised, and for the latter there is no reason why the working roads of a mine should not be as well lighted as those above ground, if by doing so an economic advantage can be proved in safety and rapidity of handling haulages. Stress is laid here on the economics in question, for unless it can be shown by trial that immunity from accident and rapidity of transport are obtained, there is no reason to change the present state of affairs.

From the point of view of safety, lighting circuits differ only from power circuits in the vulnerability of the lamp. Hot-wire lamps with short, thick, filaments are relatively more dangerous than those with finer wires, as previously shown for carbon lamps. The voltage on portable lamps is limited by the weight which can be carried, but the future of fixed road lamps might well be in the direction of running them at the signalling voltage, 25, permitted everywhere inbye, and using standard car lamps, protected from mechanical damage by the usual glass and metal shades. If the voltage is raised much above 25 a new condition enters. There is for all conductors a minimum arcing voltage. The spark at break of a 100-volt 16-candle-power carbon filament will fire gas if the broken ends remain in fizzling contact. That at 25 volts will not, as the arc cannot persist. There is, again, a remarkable difference between direct- and alternating-current breaks as a source of ignition. Ignition arising from broken lamps is regarded chiefly from the risk of contact of gas with the hot, unbroken, filament. Ignition of hydrogen mixtures, taken as the most sensitive, begins with most metals at a temperature well below red heat, at that in fact at which thermionic emission from the wire is first observed, *i.e.*, about 200 deg. C. It always begins by surface combustion, the heat from which may fire the rest of the mixture or may be dissipated by radiation so rapidly that self-ignition does not occur. The least igniting current is a linear function of the diameter of the wire. Methane can only be ignited by any hot wire below a temperature of about 1,800 deg. C. when a current of gas is swept over the wire. With platinum wires 0.01 cm. in diameter, over 2 amperes are required to reach ignition conditions, and as often as not the wire melts without firing the gas if the circuit voltage is low. With tungsten wires there is no difference between the igniting currents of hydrogen, methane, carbon monoxide or coal gas, and the wire is always red hot before ignition of the mixtures occurs. The igniting current is independent of the proportion of inflammable gas in the mixture in the case of all the paraffins, and is independent of total gas pressure down to one-third of an atmosphere or up to seven atmospheres. Electric or magnetic fields have no influence on hot-wire ignition. Ignition by tungsten wires below 0.2 mm. diameter is more difficult than with any other metal—a fact of importance in mining, since no greater safety could be obtained by the use of filaments of other metals than that now commonly employed.

A recent decision of the United States Bureau of Mines makes it necessary to provide some automatic means of cutting off the current in a hot-wire vacuum lamp as soon as the glass is cracked so that an inflammable mixture may enter. One method of doing this consists of a pneumatic collapsible chamber which operates a small switch contact when air is admitted to the lamp. The smallest pressure at which it will operate is about 1/25th of an atmosphere, more usually about 1/10th. Firedamp is not inflammable by hot wires at pressures below one-third of an atmosphere. There is here a very fair margin of safety.

A simpler and safer plan is to provide an indicator on each lamp, either electric or oil burning, to give a danger signal to the worker when a dangerous proportion of gas is present, so that he may withdraw from the place until the ventilation copes with the inrush of gas. (Two such lamps were shown in operation.)

A complete break of cable is very rare in coal mining. A fall of stone may force the conductors into contact with one another or the sheath or armouring. In such a case protective cut-out gear operates.

Practical tests show that with modern armoured cables the risk of open sparking due to the damage of a cable by a fall is slight, and the further condition that there should be at the same moment a mixture of firedamp and air between 5.6 and 14.8 per cent. makes the possibility of a local explosion from this cause remote. It is, however, possible that a cable may be drawn out of a junction box by a fall, but the break of circuit will then have taken place within it, and the enclosure must be strong enough to deal with the arc until the trip-gear operates. In pulling clear there may be an external break of circuit.

In the case of direct current there is for every gauge

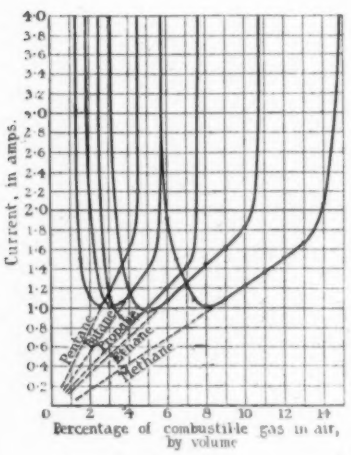

FIG. 4.

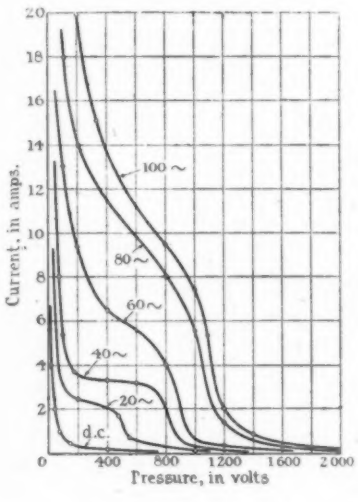

FIG. 5.

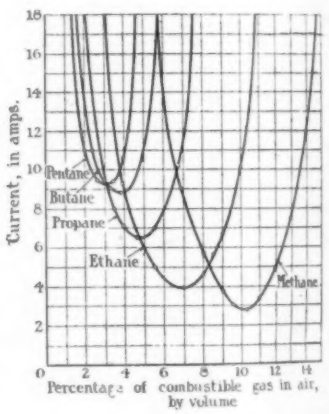

FIG. 6.

Fig. 4.—Influence of Proportion of Gas in Air on Least Igniting Direct Currents.

Fig. 5.—Influence of Frequency on the Ignition of Methane by Transient Arcs, at Various Voltages.

Fig. 6.—Influence of Proportion of Gas on Least Igniting Alternating Currents.

mixture a sharply-defined current which just causes ignition when broken in it. Fig. 3 gives, for pure methane, the range of variation of the least igniting current with voltage when iron poles are used to resemble armouring. The curves have a mean equation $(v-15)/(i-0.11)=10.5$. Below 15 volts ignition by break of a non-inductive circuit is extremely difficult, if not impossible, and at high voltages a current of about 0.1 ampere is sufficient. The lower voltage is below arcing potential, at the higher a transient arc becomes a spark characterised by ionisation by collision in the field across the break.

The characteristic phenomena of ignition by direct currents are well illustrated by fig. 4. Mixtures of firedamp and air are most easily ignited at 8 per cent., and, though this is a point of less practical importance in this country, all the paraffins have the same least igniting current in their most sensitive mixtures.

The essential feature of ignition by alternating-current break sparks is the remarkable influence of frequency at different voltages, illustrated in fig. 5. Thus at 500 volts a direct current of 0.2 ampere will cause ignition, quite possible in a badly-earthed armouring with a fault developing, but at the same voltage and a frequency of 100, 11 amperes are necessary, other things being the same, a ratio of 55 to 1 in favour of high-frequency alternating current. At 50 periods it is about half this—quite worth having.

Remarkable as the curves are, they are perhaps less striking than those of fig. 6, a set of parabolas symmetrical between the limits of inflammability, so that the most easily ignited mixture is midway between them. The practical bearing of this is that when alternating currents are used there is much less risk of ignition of the weaker mixtures. The most sensitive point is 2 per cent. higher than in fig. 4. Gases of greatest calorific value are most difficult to ignite; a fact that calls for explanation by those who support the thermal theory of ignition.

(To be concluded.)

Discussion in London.

MR. C. P. SPARKS opened the discussion by referring to the paper as an excellent example of the value of research. The use of electricity in mines depended a good deal on the ability of the mine manager, who had sole responsibility, to decide on what was safe; and it would be appreciated that it was by no means easy to decide when the official regulations contained such a definition as that of open sparking and others. The paper would, therefore, be helpful in indicating the difference between safe, risky, and dangerous types of spark. Electric bells were first used in mines probably about 45 years ago, but the fact that they were only suspected of being dangerous in 1913 showed the value of research. Better illumination would increase safety, besides being valuable in other ways; the use of electricity in mines had many advantages, not the least of which was that it was a means of abolishing underground horse haulage.

Mr. NELSON thought that the author's work had been abundantly worth while. He agreed that the risk of electric shock had been eliminated; efficient ventilation was obtainable, and open flame could be prevented, but, regarding better illumination, he had often suspected that the miners themselves did not want it. There might be difficulty in getting miners to adopt some of the improvements outlined in the paper; by all means light the roadways better, but the illumination of the coal face was another matter. Better lighting would reduce nystagmus. Of the electricity used in mines, about 80 per cent. was a.c., but the use of d.c. was increasing, and it ought to be abolished.

Mr. J. A. B. HORSLEY (Mines Dept.) said that the electric motors used in mines aggregated 1¼ million h.p. The human element could never be ignored. He had known cable injury by a fall of rock to set fire to timber that had fallen with the roof, due to a "burst," *i.e.*, the short-circuit arc persisting long enough to burn a hole through the conductor covering. He trusted that the author's suggestions about better lighting at the coal face would lead to something being done, but could they get over the regulations in that respect? Regarding the author's earthing plate, the joint between the cable and the rod should be above the filling material. Electrical accidents, all of which were preventable, were a small proportion of the total mine accidents.

Mr. S. W. MELSOM emphasised the value of the paper and of research, and thought the results obtained were applicable to other sections of the industry. Both coal and earth, when dry, were insulators; pure water was also an insulator, and it was only the impurities in the latter that rendered the whole conducting. Under certain conditions, when the earth plate and its surroundings were quite dry, it was possible that no leakage would take place, and therefore no fault would be indicated. To have to periodically pour water over an earth plate was relying too much on the human element. A 2-ohm earth was thought to be good, but what was the best figure for mining work?

Mr. HIGGS said that electrical endosmose was very important, and was apt to be forgotten. He agreed with the previous speaker's remarks about earthing, and explained that the earth's resistance increased with the fall of temperature, due to the moisture in the soil freezing.

Mr. W. M. SELVEY said that open sparking was not always to blame, and there was some natural protection in that dangerous conditions very seldom occurred at the same time. They must go on improving self-protective apparatus, and use either as low or as high a pressure as possible; 50 volts or less for lighting, and high voltage for everything else, so that trip gear could operate immediately a fault took place. He had adopted such a policy in a certain pit, and there had only been three shut-downs in three years, two of which were due to too hasty operation of controllers, resulting in flashes over. When faults occurred on such rare occasions everybody wanted to know why they happened, which was all to the good. Mr. Horsley's "burst" must have been a case of a 500-volt d.c. cable, because with a high-pressure a.c. cable the trip gear would operate too quickly to allow anything of the kind to take place. It was imperative that earthing must be good. He had erected a brick enclosure round an earth plate in order that no one could forget its existence, and he had considered reinforcing cable armouring by providing special copper strips. The regulations would have to be altered to allow electricity to be used at the coal face, but if the author was showing them how to use electricity safely in places where gas existed, he was doing something wonderful.

Dr. W. M. THORNTON, in reply, explained that better illumination at the coal face was not merely a question of getting more coal; it would greatly reduce accidents by falls of roof, &c. They already used electric coal cutters at the coal face, and his suggested lamps could probably be made to plug into those machines, if it were considered inadvisable to have trailing cables in that position. Mr. Horsley's "burst" cable was probably a bitumen cable, which type should never be used in mines. More inspection seemed to be needed to avoid electricity being blamed for faults caused by imperfect workmanship.

Testing for Firedamp.—In a report (Memorandum No. 10, H.M. Stationery Office, price 1s. 6d. net) on testing for firedamp just issued by the Miners' Lamps Committee of the Mines Department, are recorded some of the devices invented to afford means of detecting firedamp in mines. One disadvantage of the devices which do not make use of the flame of the safety lamp is that they cannot be used for illuminating purposes, so that the fireman must carry a safety lamp in addition to the detector, or the detector must be attached to the lamp. The most serious disadvantage, however, with the majority of the devices is that they do not give automatic warning of the presence of firedamp, such as the flame-lamp gives, but require to be manipulated, often most delicately, before any indication is obtained. Most of the methods depend upon physical properties of firedamp which may easily be masked if blackdamp is present in addition to firedamp, so that the reliability of the indications is destroyed. A number of inventors have suggested estimating the quantity of firedamp present in mine-air by measuring the contraction in volume (or reduction in pressure) when the methane is burnt by means of a platinum spiral heated electrically. These include Monnier (1881), Coquillon (1887), Lewis and Maurice (1887), Grehant (1894), (1906), Burrell (1912), and Williams (1922). This method has possibilities if the necessary apparatus can be condensed into small enough compass to attach to a miner's electric hand-lamp without rendering the lamp clumsy. The Williams "Methanometer" meets this requirement, and at the same time is accurate in its indications; the instrument suffers, however, from the disability common to all such devices, that no indication of the presence of firedamp is given by it until certain operations have been performed by the fireman or miner. Rapid electrical methods of testing for firedamp depend on the rise in temperature of a wire of platinum or platinum alloy heated in the first instance to dull red heat by an electric current from a battery, when it is introduced into a mixture of firedamp and air. This phenomenon is due to the combustion of the mixture on the surface of the platinum wire. The degree of rise of temperature depends on the amount of combustion that takes place, which, in turn, depends on the composition of the firedamp air mixture. Liveing (1878) compared the luminosity of two wires, both heated electrically, one being confined in pure air, and the other exposed to the atmosphere to be tested. The method appears to have given accurate results when the platinum wires were new, but it was found that they could only be used for a short time, since a change occurred in them with use which altered their behaviour. Murday (1890) suggested measuring the expansion of a platinum wire, but his apparatus was large and unwieldy. The measurement of the change in the electrical resistance of a platinum wire was suggested by Leon (1901), and adopted later by Ralph (1910). This is, perhaps, the most promising suggestion for a suitable electrical detector for pit work, but thoroughly satisfactory apparatus has still to be devised. There is, as yet, nothing to equal in general utility and reliability the miners' flame safety-lamp as ordinarily employed. It is possible that the development of electrical devices for estimating firedamp may provide an instrument capable of the desired accuracy and sufficiently simple in operation, if this has not already been achieved in the Williams "Methanometer." Further development of the indicator invented by Ralph should also provide a suitable instrument.

Trade Conditions in South America.

Venezuelan Prosperity.

MR. T. J. MORRIS, His Majesty's Chargé d'Affaires, Caracas, in his report* up to September, 1923, gives an encouraging account of conditions in Venezuela. He points out that the country was not seriously affected by the war, and he sees no reason, unless untoward events occur, why its economic development should not expand and improve steadily. Cattle raising and agriculture are the principal pursuits of the population, and manufacturing industries also are on the increase. Amongst the last are cotton textiles, sole leather, common soap, candles, glass, cement, cigars, and cigarettes. There is a favourable trade balance, the surplus of exports over imports during the first half of 1922, which is the latest period for which figures are available, having amounted to £1,500,000. The value of the Venezuelan market to British exporters is, Mr. Morris says, about £1,500,000. He adds that firms seeking to do business in the country will start with the advantage of finding a marked preference, within reason, for British goods, and, as an additional factor in their favour, they will find the attitude of the Venezuelan people particularly friendly towards them. Englishmen have always been closely associated with the country, and the people seem pleased to recall this ancient friendship and how much they owe to English support in their struggle for independence. It is, moreover, to British enterprise and capital that Venezuela, like many other countries, is indebted for its position as a factor in the world's market to-day.

The principal railways, harbour works, tramways, electric light and telephone services are products of British capital, and owing to the way in which these and the other British concerns in Venezuela have invariably been managed, and the excellent type of men they have always had associated with them, English business methods are greatly appreciated throughout the country, a fact which in itself should not be without value in enabling United Kingdom manufacturers to withstand competition. At the same time it must be remembered that competition is keen. Formerly it came mainly from German firms, but Mr. Morris says that the Americans have now entered the market, and are rapidly getting control of it. The reason for this is mainly that many of the petroleum interests in Venezuela are American. The United States also has the advantage of proximity. Competition, he states, tends more and more to resolve itself into a question of prices, business organisation, and efficiency.

The Chargé d'Affaires surveys import trade conditions in the principal lines, and says it is satisfactory to find that 80 per cent. of the textiles placed on the Venezuelan market are of British manufacture, though the cheaper cloths still come in considerable quantities from the United States. As to machinery, there is now a tendency to ask for quotations, particularly for cotton and sugar machinery, and also gas engines, from the United Kingdom. There is a brisk demand for small hardware goods, such as cutlasses or machetes of a good quality, more particularly for the coffee industry. Good steel cutlasses are scarce, so are scientific instruments for engineering purposes. There is little demand for good quality earthenware and porcelain, except perhaps amongst the more wealthy people in the towns; enamelware and earthenware are necessarily preferred by the poorer inhabitants.

There is nearly 1,000 kilometres of railway open for traffic in Venezuela, and attention is being given to the advantages of electrification. Mr. Morris reports that on the principal line, which connects the capital, Caracas, with the port of La Guaira, the possibility of replacing oil by the use of electric power is being investigated, and three Diesel engines are under consideration for the purpose. It is thought that a more efficient service and greater economy will result.

Other electrical activities are described below:—

The Venezuela Telephone and Electric Appliances Company, Limited, was formed in 1890 to take over and develop the business of the Inter-Continental Telephone Company (an American enterprise). The company's main office in Venezuela is situated in Caracas, where it has some 4,500 subscribers. The main office is connected by trunk lines with some 27 smaller offices, ranging from 500 subscribers in Valencia down to smaller centres of 10 and 20 subscribers in villages and hamlets. All these offices are interconnected by toll lines. The longest speaking distance within the system of the company is about 200 miles. The total number of subscribers is about 6,200.

The United Electric Tramways Company of Caracas, Ltd., was formed in 1907, and holds all the shares of the Compañia Anonima de Tranvias Electricos de Caracas. The latter company maintains the only tramway service in the capital. The company has about 17 miles of track, and gives a five-minute service throughout the greater part of the city. The company carried about eight million passengers last year.

The Venezuela Electric Light Company, Ltd., was established in 1912, when it took over the then existing local electric light company. It maintains a very efficient service of electric lighting in the town of Caracus. There are now 10,653 consumers, as compared with 2,061 when the company took over from the old local company.

* H.M. Stationery Office or D.O.T. Price 1s. 0d.

Uruguay's Future.

The British Vice-Consul of Montevideo, Mr. A. E. Cleugh, is unable to report any improvement in the economic position of Uruguay since 1922. The country suffers from lack of variety in industry, and depends too greatly upon cattle raising. In order to develop allied agricultural pursuits she needs labour, and this she finds it difficult to attract, in view of the high cost of living and the difficulty of expropriating suitable land. As these obstacles stand in the way of industrial progress, the Government has little other method left for improving the economic situation of the country than by increasing taxation and raising loans. Thus no real progress is made.

If there is an improvement in the European markets for Uruguayan meat, the effect will be beneficial to Uruguay, and Mr. Cleugh says that there is a general impression that the worst stage has been passed. Trade returns and customs receipts are showing a gradual but consistent advance, and any permanent re-establishment of European peace and prosperity will, without doubt, accelerate this movement. Surplus stocks are on the way to being exhausted, and buying, particularly of textiles, has been relatively brisk. During the first six months of 1923 imports of industrial machinery and spares amounted to $323,190 in value, as compared with $356,319 in the first half of 1922. With regard to competition, the Vice-Consul reports that Germany's export trade with Uruguay shows a steady increase from year to year, and she now stands third on the list. In addition to strenuous efforts to increase their exports, German firms lose no opportunity of tendering for contracts of all kinds, and keep in close touch with the public offices concerned. France and Belgium are also proving strong competitors, and are making a determined bid for the textile and silk-goods trade. Very large quantities of French silks have been introduced into the country recently. There is a growing tendency for retail firms to import directly without the mediation of the wholesale dealer, and it is a peculiarity of this market that the wholesale trade is not the distinct and separately-organised business that is usual elsewhere.

It is encouraging to learn that, in the opinion of the Vice-Consul, British trade is in a very favourable position to make a bid for South American markets, particularly in view of the decline of business with the United States. In connection with the utilisation of the Rio Negro and its falls, investigations are being made into this scheme for the construction of hydro-electric works, which involves the supply of additional electric power to the neighbouring district and also to Montevideo, and other works of importance. Mr. Cleugh says that there are, however, certain natural and technical difficulties, and it remains to be seen what opinions are expressed by the expert engineers who are investigating the project.

The Minister of Industries has called attention to the inconveniences of the present telephone situation, and asked for despatch of the bill relative to a State underground system, which has been before a committee for a long time.

Paraguay after the Revolution.

In spite of the disturbed political situation in Paraguay, Mr. Paris, H.M. Consul at Asunçion, points out in his recent report* that exports of the country's staple products have not fallen, but, on the contrary, a satisfactory increase has been recorded. This circumstance should reassure those whose interests are bound up in the country. He admits that any forecasts for 1924 would be premature, though it may be truly said that prospects are distinctly brighter than they were twelve months ago. Britain's share of the import trade is just under 25 per cent., and is still rather more than that of the United States. Argentina's share appears from the official's statistics to be about one-third, but it must be remembered that imports from that source probably consist to a considerable extent of British goods. Paraguay importers appear to prefer to buy in Buenos Aires, in spite of slightly increased cost, in order to avoid risk and delay. Mr. Paris finds that the United Kingdom has been steadily losing ground in the hardware trade, and attributes this to insufficient representation and lack of knowledge of local requirements. The business sometimes amounts to as much as £300,000 annually. The value of the imports of electrical goods and machinery has varied considerably, the figures being as follows:—1913, £16,950; 1920, £33,167; 1921, £12,115; 1922, £5,018.

* H.M. Stationery Office or D.O.T. Price 9d.

Electric Water Heating.

At the Salesmanship Conference of the E.D.A., on Friday, January 18th, held at the London School of Economics, Mr. C. G. Nobbs (Messrs. Geo. Nobbs, Ltd.) read a paper on "How to Market Hot Water."

Mr. J. H. Bowden (Poplar Electricity Undertaking), who presided, opened the meeting with an account of the progress made in Poplar in the direction of heating water electrically for public baths. The Baths Committee had applied to the gas company, which was heating water at a number of isolated baths, for a reduction of price, but it was refused. It then went to the electricity undertaking, which put up a reasonable proposition, on the thermal-storage system, the cost being comparable with the cost of heating the water by gas. The gas company then reduced its price by 30 per cent. However, an experimental electrical plant was put in to deal with 400 to 500 baths per week, which was half the number of baths usually provided. On starting up the plant, it was found to be capable of dealing with the whole demand, between 800 and 1,000 baths per week. The supply was given during the night; the water was kept hot by thermal storage, and the charge was on the basis of a small increase on the coal cost per unit. Other uses of electricity, he said, where the load on the station was imposed during the night, were break-baking (one baker at Poplar had increased his output enormously since adopting electricity), and in connection with colour manufacturers' drying chambers.

Mr. Nobbs then read his paper, which was of a more technical nature than is usually the case at these conferences, and dealt with problems connected with domestic electric hot water supply. The most prevalent market at present was for apparatus for constant supply for domestic purposes, which Mr. Nobbs divided into the following three main classes:—

(a) The local storage system in which a hot-water container, complete with heater, was fixed adjacent to the fitting it was intended to serve;

(b) The geyser or instantaneous water heater, which was likewise positioned at the point of draw-off; and

(c) The central storage system, in which the water was heated in a main storage calorifier, and thence went through distributing pipes to the draw-off taps in the various parts of the building.

In all these methods it might be taken as an indispensable condition that the heating equipment should consist of heaters of the immersion type, in which the whole of the heat generated, except that from the external terminal box was given up to the water. Thermostatic control was essential for economy in consumption in the case of both storage systems, but was largely a question of expenditure and first cost. In the author's opinion, the local storage and the geyser systems were but passing phases brought about by the excessive price of energy and the consequent necessity to reduce electrically-generated heat losses to their minimum. This was effected in both systems, but generally at the cost of some inconvenience to the user; therefore, he believed the central storage system, which veritably provided hot water "on tap," would be the more permanent system, and would constitute a lucrative market for contractors, manufacturers, and supply authorities as soon as the last-named reduced their charges for energy for this class of steady and "off-peak" demand to a halfpenny per unit or less. He laid considerable stress on this point.

Dealing with the systems in more detail, he said with regard to geysers that, to be of any practical use, they should be loaded from 3 to 6 kW for basins and sinks, and 9 to 12 kW at least for baths, and then had a load factor of only 2 per cent. So-called geysers of low wattage up to 2,000 watts were comparatively useless for most average requirements. Their dribble of tepid or hot water created an exasperated propagandist with views inimical to the industry. "Safety first" was the slogan that should expel from our market the cheap forms of geyser of the water-resistance type, or that in which the water was "alive." "Let the gas geyser fulfil its fell purpose alone," he said. The future market of the electrical hot-water engineer lay not only in the installation of new systems, but in the conversion of a large number of existing solid and gaseous fuel fired central-storage systems or as an auxiliary for summer working. The conversion might be effected by fitting new flanges to the existing cylinder or tank and inserting the immersion heaters and thermostat directly therein. In deciding the power of the electric heaters for existing installations, a careful survey should be made of the apparatus and the power required to offset the heat losses added to that for a stated draw-off demand. Most old installations were put in without regard to economical working, so that a careful survey would frequently disclose points where improvements, such as lagging of the storage tanks and mains, re-grouping of pipe runs and elimination of circulating pipes, &c., could be effected with a consequent reduction in energy consumption. He exhorted his hearers not to buy so-called cheap water-heating apparatus; water-heating apparatus was probably the hardest worked piece of plant in the house, yet it had the minimum of attention.

The author then gave examples of domestic hot-water supply, and showed how installations could be so arranged that the water-heating load would come on the central station at off-peak times. The location of the hot-water tank might also make all the difference between success and failure; it should be at a high level, certainly above most of the draw-off points. Circulation of water in the pipe work was then eliminated or reduced to a minimum, heat losses only occurring when hot water was actually drawn off. The total length of pipe-work had also to be considered, as well as simplicity in lay-out and the time occupied at the most important draw-off points in running off luke-warm water in the pipes before scalding water was obtained. These considerations demanded a fairly central position for the tank, or one somewhat above mid-way level.

Discussing other selling hints, the author gave simple fundamental formulæ useful for water-heating calculations, and connecting kilowatts, gallons of water, and time in hours, with factors for various efficiencies. In conclusion, he said they had the best possible proposition to put before the public in electric hot-water supply, by reason of its absolute safety, simplicity, convenience, and cleanliness. They should talk costs in £ s. d. The electric hot-water supply field represented at least as much revenue as the cooking and lighting load put together, and this with a maximum demand of about 25 per cent. of that of the cooking. Therefore, it surely merited special terms—at least half the rate charged for cooking energy. Given a low electricity charge, hiring facilities, and a live set of electrical hot-water contractors, then undoubtedly the prospective good business was almost without limit in the domestic field.

Discussion.

Mr. Shears (Hackney) agreed that the cost of energy was the main difficulty. In Hackney they had a rate of 0.6d. per unit, with the right to cut off the supply between 4 and 6 p.m. Thermostatic control had seriously to be considered, in order to obtain reliability. As to the conversion of ordinary residential houses, the difficulty there was heat losses through the pipe systems from the tank to the draw-off. After commenting on the heavy cost of apparatus, he discussed hiring-out, and said he was afraid there was not sufficient demand at present for that to be done.

Mr. F. Sully (Marylebone) said he had had experience of the heating of water in public conveniences for nine years. In that period these conveniences consumed 28,000 units for lighting, and 126,000 for the washing basins. There were 35,555 washes, which, with energy at ¾d. per unit, worked out at ¼d. each. There were two immersion heaters, of 5 kW loading each, one controlled thermostatically and the other by hand. One of the elements had run for nine years without attention. Though admitting that it was better to have thermostatic control in a kitchen, it was surprising how little energy it saved. One of his consumers had made a test for nine days with thermostatic control, and for nine days with hand control. With thermostatic control, using an average of 50 gallons of water per day, the number of units consumed per hour was 1.3, and with hand control it was 1.35. Mr. Sully emphasised the importance of providing a system of thermal storage, so that the water-heating load could be dealt with at night. He had taken records of some flats in his area which were equipped electrically for lighting, heating, and cooking, which showed that by introducing a storage system for night work the station could get practically a 24-hour load.

Mr. E. E. Sharp said he had been using a 2-kW immersion heater for five years, and had never had trouble with it. He had no thermostatic control. The current could be switched on automatically or by hand, and though that would seem to have the disadvantage of not giving hot water continuously, it gave it when it was wanted. He considered that the consumption was lower than if he had it going all night. A method which might be applied was to have a limiter with a switch in the heating circuit, but controlled by a coil in the lighting circuit. It could be arranged that it switched off the heating circuit when the lighting came on.

Mr. C. O. Bastian said it was foolish to hope for success in promoting the adoption of electrical heating of water by putting an immersion heater into existing hot-water apparatus, having regard to the heat losses through the pipes. The extent of pipe losses was not fully realised. There might be 25 ft. of ¾-in. pipe between the scullery tap and the tank, holding half a gallon of cold water, and in order to get a pint of hot water, the half-gallon of cold water must be drawn off. With the ordinary hot-water circulating system in private houses to-day, 66 per cent. of the heat was wasted down the sink, and electricity could do away with that.

Mr. F. Tait (Poplar) said they wanted an appliance which would switch off the heating at times of peak load, and they would then get a load factor of practically unity. By doing that, provided there was a sufficient amount, there was no reason why the load factor at the station should not approach 100 per cent. in the future; the cost of energy for heating water could be cut down to ¼d. per unit, with a 100 per cent. load factor, under present conditions. As to the relationship

of hot-water supply to general load, he said that for an output for general supply of 80,000,000 units per annum, if the load factor at the station were 100 per cent., there would be available about 123,000,000 additional units for heating water.

Mr. Ross (G.E.C.) asked if consumers were to have three meters, one for lighting, one for heating, and one for water, each at 2s. 6d. per quarter. Also, must a consumer have two or three separate heating units for each installation, to avoid pipe losses?

Mr. F. TREMAIN asked if Mr. Nobbs had considered superheating at the outlet of the water. He suggested research to discover whether pipes could be lagged. When he approached his supply authority he was told that it could not help him because there was no demand for water heating. That was deplorable.

Mr. HOPE (Baths Superintendent, Poplar) said that when gas was used the cost of heating the water for each bath was 3d. With electricity, the last quarter's figures were 2.18d. The gas people had allowed reductions of 2½, then 10, and then 35 per cent. off their original charge in order to compete with electricity, and with the reduction of 10 per cent. on gas, electricity was cheaper.

Mr. LOVELL (Stoke Newington) said that supply authorities, with the three-wire system, had difficulty with regard to balancing. In a recent case his authority could not put in a thermal storage system for heating water, because it could not cope with the load on account of difficulties with balancing.

The CHAIRMAN said he had dispensed with a thermostat owing to its cost.

Mr. NOBBS, in reply, said a thermostat had nothing to do with inefficiency of apparatus. As to conversion of existing apparatus, where there were long pipe lines, it did not matter so much at the sink as at other draw-offs if they had to run off a certain amount of cold water. If pipes were lagged, the water did not have a chance to cool off much, because the sink draw-off was used most frequently during the day. Each case had to be looked at from the point of view of expediency. A number of heaters dotted over the house would not satisfy the majority of people. The thermostat saved a lot of energy as compared with hand control by inexperienced people, and was worth even its present cost. He disagreed with Mr. Bastian that there was a loss of 66 per cent. down the sink. The installation of a third meter for water heating might be avoided by a multi-part tariff, or a system which combined a thermostat and a clock switch, the latter operating in off-peak times, so that the heater was cut off during peak times, and the thermostat looking after the consumption of energy. He did not think anything was gained in efficiency by superheating by a geyser at the outlet served from a preheater such as storage. It would increase the number of wiring points, and would necessitate having gadgets at the top, which involved a switch or complicated mechanism which the user would have to turn on simultaneously with the water valve. The balancing of geysers was an easy proposition. With a well-designed geyser, *i.e.*, properly insulated, there was a double-pole switch working from the outers. The apparatus was automatically earthed, it was connected with the water supply, and, in conjunction with a well-insulated immerser, there was no difficulty in putting in a big switch to break 10 to 12 kW, and lock that with a water valve to safeguard against turning on the current when the water was not flowing, or *vice versa*.

An Infantry Radio Outfit.

The Marconi Observation Post Set.

DURING war operations the efficiency of artillery action depends largely upon the ability of individual battery commanders to obtain immediate and accurate information regarding the effect of their fire, and the nature and position of any new target offered by the enemy. Owing to the long range of modern field artillery and to the secluded positions chosen for mounting guns, observation posts have to be established as near to the lines of the enemy as possible, and the maintenance of uninterrupted communication between such posts and their respective gun positions is of vital importance.

During the early stages of the late European War, such communication was carried out chiefly by means of land telephone and telegraph wires which, owing to their exposed condition and their vulnerability, were a continual source of trouble.

For obvious reasons radio telegraphy or telephony offers an ideal means of communication for this purpose, but one of the difficulties was how to obtain sufficient selectivity to enable a large number of sets to work simultaneously in close proximity to each other on a limited front. However, Marconi's Wireless Telegraph Co., Ltd., has designed a set which will, it is claimed, fulfil the requirements of such a service, and probably supersede the land wire system hitherto employed by field artillery regiments. Moreover, the set is so light and mobile that it will fill a long-felt want for a means of short-distance emergency communication, the need for which continuously arises in military actions.

The type Y.P.1 set is a combined valve transmitting-receiving set arranged for telegraph and telephone working. The apparatus is divided into a number of self-contained units chosen with a view to obtaining a uniform distribution of weight during transport and a convenient arrangement of the apparatus when erected for working. Three of the units, *i.e.*, the transmitter, the receiver, and the battery and generator, are carried in knapsacks designed to be attached to the standard military equipment, while the aerial and earth gear is carried in a canvas case. The more delicate portion of the apparatus is mounted in two light weatherproof travelling cases fitted with folding legs. The instruments do not have to be removed from their cases for working, and in order to provide for circumstances where the apparatus may be exposed to the weather, they have been so designed that they can be operated with the lids closed and only a small flap in front kept open, as illustrated in fig. 1.

The short wavelengths employed (190-200 metres) give efficient radiation over a range of three miles and upwards when using aerials supported only a few feet from the ground. Telegraphy is carried out by buzzer modulation of the carrier wave, and the high selectivity of the receiver, together with the distinctive note which can be given to each transmitter by means of the buzzer, enables as many as sixteen stations to work simultaneously within an area of three square miles without mutual interference.

The aerial usually employed at the observation post end

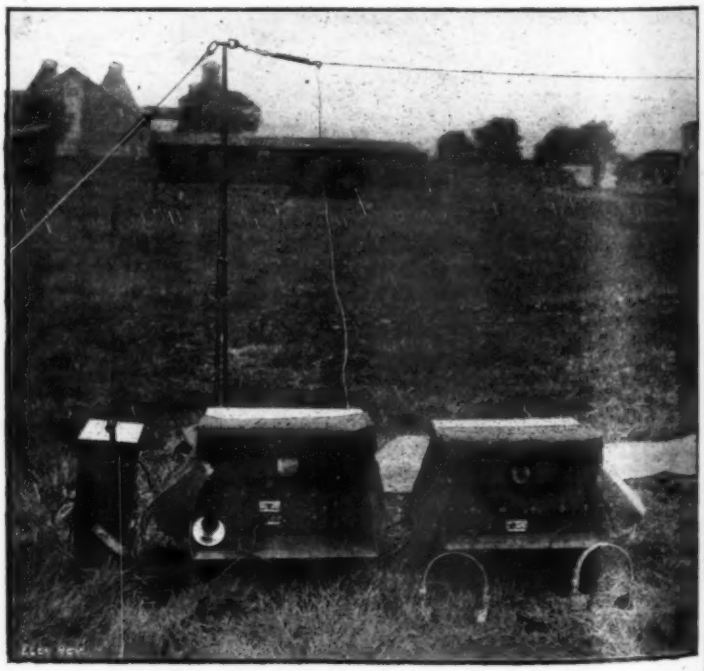

Fig. 1.—Marconi Type YP1 Radio Set.

in front line trenches consists of a single wire supported at either end by a light bipod structure from 2½ to 5 ft. above the ground. At the battery end it is, as a rule, possible to extend the range by using a single wire aerial supported by one 30-ft. or two 15-ft. masts.

It is difficult to give definite range figures, but a conservative figure for telephony range between two such sets under normal working conditions is three miles when one set is provided with two 5-ft. supports and the other with one 30-ft. mast for the aerial support. The set is designed to transmit

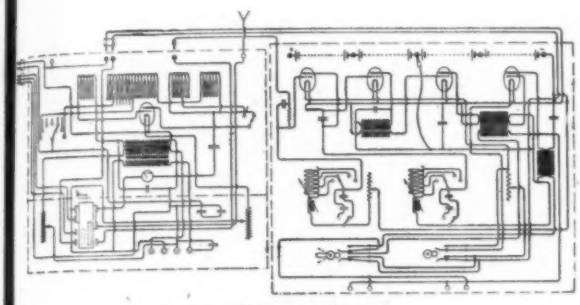

Fig. 2.—Circuit Diagram.

and receive on any wavelength between 190 and 260 metres, and the full equipment is divided into loads of 41.5, 43.5, 44, and 28 lb. suitable for knapsack transport by four men.

For more permanent positions, instead of the hand-driven generator, an inert battery can be provided for supplying the anode current to the transmitter; alternatively, a rotary transformer can be run off an additional 6-volt battery.

The standard equipment includes one M.T. 5B. transmitting valve (one spare being also carried) having a filament voltage of 6 V, total filament current of 2 A, and an anode voltage of 400 V; while the receiver utilises 4 D.E.R. valves with a filament voltage of 2 V, filament current of 1.6 A, and an anode voltage of 45 V. Fig. 2 is a diagram of connections.

The transmitter, fig. 3, comprises one three-electrode valve; an aerial tuning inductance tapped at seven points and connected to a stud switch for coarse tuning; a variometer in series with the aerial tuning inductance, for fine tuning; an adjustable reaction coil; a "transmit-receive" change-over

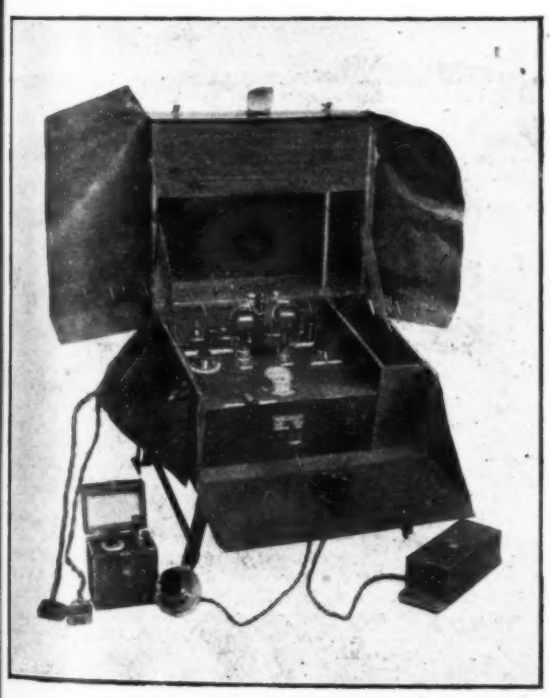

Fig. 3.—The Transmitter.

switch; a variable microphone resistance; a variable filament resistance; a two-way anode tapping switch, and an aerial ammeter.

The telegraph unit comprises an adjustable note buzzer and a transmitting key that by means of a flexible lead is plugged into sockets provided on the transmitting unit, which also serve for the microphone of the solid back type. The wavemeter consists of a variable inductance, a fixed condenser, and a crystal detector calibrated in metres, and covers the wave-range of the transmitter.

The battery box contains the 6-volt 25-ampere-hour and the 2-volt 40-ampere-hour batteries, the box being arranged as a stand for the hand generator.

The receiver, fig. 4, comprises four valves, one for tuned high-frequency amplification, one for detection, and two for note magnification, one of which can be cut out of circuit; aerial and anode tuning circuits each including an inductance

Fig. 4.—The Receiver.

tapped at four points and connected to a stud switch together with a two-way switch for connecting either one or two condensers in parallel with the inductance for wave selection; a variometer for fine tuning; variable resistance for controlling the reaction; a variable filament resistance, and a filament switch.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

The Prospects in New Zealand.

In your correspondence columns for December 14th I notice a note, signed "Diverter," inquiring as to the prospects for electrical workers in New Zealand. The writer, having resided in that country for some years prior to a few months back, would like to express as well-balanced an opinion as possible on the matter.

I should like to explain that, being a technical graduate and also an experienced practical man familiar with several divergent branches of the electrical industry, and also being pretty well known, during the last two years I was never actually out of employment, though I made several changes in that time. *But this was solely due to the combination of advantageous circumstances outlined above.*

Many strangers and men familiar with but a small section of the electrical business were out of employment, and in some cases were reduced to very unfortunate circumstances.

The employment situation is such that last winter, in Wellington, a fund for the distribution of free meals to the necessitous was established in the City Hall; in other words, a "soup-kitchen," such as, I believe, are very welcome now in Central Europe. It is well that intending immigrants should know these things. I have lived and worked in many of the "new" countries of the world, but I will say that, according to my observation, the greatest number of misinformed immigrants appeared to be those who arrived in New Zealand since the war.

The fact that there are projected and partially developed hydro-electric schemes under way must not be taken as a certain indication of good prospects for electrical workers. Many of these schemes are in a state of suspended animation.

About a year ago I was privileged to interview the managing director of a world-renowned British engineering concern who was visiting New Zealand. He expressed the personal opinion that the hydro-electric schemes were

altogether too colossal for a population of only one and one-quarter millions.

"Diverter" should definitely understand that whilst unemployment may make it just as difficult to "get a living" in New Zealand as in England, the prospects of getting what we all call "a good job" are very much smaller in the Dominion. The reasons are not far to seek. There are several universities there, and a regularly constituted college of engineering. When one considers the small population, it will be understood that these places are becoming veritable "diploma mills" turning out quantities of B.Sc.'s and B.E.'s out of all proportion to requirements. In addition, there is in New Zealand a very strong anti-immigrant feeling. This feeling is positive and definite, and has been quite vulgarly expressed in public by Members of Parliament, the Mayor of Wellington, and other well-known men. There are plenty of good experienced electricians of all kinds in New Zealand, and the immigrant generally finds that his first job is digging post-holes or punching concrete walls. Every man a pick and shovel in New Zealand, electrician or whatnot he may be. This soon disgusts the average English immigrant full of hope and roseate dreams of wonderful opportunities. But more disgust follows, for he finds that the Colonial man knows as much as he, and, in addition, has all the preference. I have seen many a good technically-trained man digging post holes in the streets, with, unfortunately, no prospect of anything else for many years to come.

These conditions are an unconscious expression of New Zealand's real labour needs. What *are* required to develop the country are labourers of the "jack-of-all-trades" variety; that is, those who can turn from pick and shovel to rough carpentering or concrete boxing, or any like constructional work.

Trained engineers and skilled engineering mechanics are not required generally, as there are already resident a great number surplus to requirements.

The whole trouble with most of the immigrants of late years appears to be lack of information about the conditions of employment, and far too much reliance appears to be placed on the often misleading statements issued by the High Commissioner's Office in London and by other offices interested in encouraging immigrants. The fact that some unfortunate English test-room assistant or other highly-skilled man is now blasting rocks around Lake Waikaremoana does not cause much consternation among the officials comfortably seated in the Strand.

Space will not permit me to explain many other things which surprise the new arrival in New Zealand. A few instances will be of general interest however.

Practically all manufactured necessities of civilised life are imported under heavy tariffs. Consequently the cost of living is considerably higher even than it is in America, always considered an expensive living country.

A minimum wage is fixed by law, and employers never pay more than the minimum, even to exceptionally expert workmen. The said minimum wage, in relation to the cost of living, is quite a whole lot lower than the wages now prevailing in England.

Membership of a trade union is legally compulsory, and, as may be expected in such circumstances, the unions are simply helpless dummies. Strikes and similar labour disturbances are illegal, and the Government does not hesitate to take extreme measures to break any strike. For further information on this point read a report on the action of the N.Z. Government in suspending the provisions of the Shipping Acts in order to break a recent marine strike.

In Wellington and many other cities, electricians, plumbers, and certain other mechanics are required to obtain licences before commencing work. In the case of immigrants, even men showing credentials of many years' experience are required to pass the licence examination, in theory and practice, before receiving a "ticket." I have seen this fall very heavily on middle-aged practical men, who have perhaps forgotten the theory of Wheatstone's bridge, or similar technical theory. Failure to pass entails a wait of one year for the next examination, and without a licence it is impossible to obtain employment. I may add that in the case of "kinema operators" and certain others the licence laws are so worded that it is legally impossible for an immigrant to obtain any licence (or employment) at all.

I advise "Diverter" to get into touch with some person, preferably an electrician, who has recently returned to England after a period of at least two years' residence in New Zealand, and obtain confirmation on the above points.

I am afraid, Sir, that this letter in its entirety will trespass greatly on your space, but I am sure that as the Editor of a technical paper read by us throughout the world, you will have some sympathy with the thousands of British men (most of them ex-Service) who have been bitterly disillusioned by the distinctly un-British treatment meted out to them, and by the many strange conditions which they were not told of before sailing.

New Zealand is the finest country in the world—yes, Sir! for scenery and in many other respects—but I never met an immigrant yet who had one-half of one per cent. of the practical information on the conditions of life and work which he should have known. In many cases, if he had had 10 per cent. of this information he would never have wasted his time, money, and prospects by leaving England.

If "Diverter" is getting a living at all in England, he would do well to spend a long time collecting definite information before even thinking of emigrating.

If "Diverter" is desiring more detailed information on particular points, I have no doubt, Sir, that you will give him my address, privately, and I shall be pleased to give him all the information within my power on receipt of an inquiry.

Inductor.

January 16th, 1924.

[We are grateful to our correspondent—who is at present in the United States—for the very full information given above, though we regret that his report is so discouraging. Readers contemplating emigration to New Zealand will do well to make sure of their ground before taking further steps. —EDS., ELEC. REV.]

Duplex Wireless Reception.

With reference to the report from the R.M.S. *Aquitania* that the chief wireless operator has succeeded in receiving two wireless messages simultaneously on two aerials, it is interesting to recall that in his early experiments in 1900, Senatore Marconi demonstrated the possibility of receiving two wireless messages on different wave lengths simultaneously with one aerial. Describing this achievement in *The Times*, of October 4th, 1900, Professor J. A. Fleming said:—

"These experiments have been conducted between two stations, one in Poole, in Dorset, and the other near St. Catherine's, in the Isle of Wight. The two operators at St. Catherine's were instructed to send simultaneously two different wireless messages to Poole, and without delay or mistake the two were correctly recorded and printed down at the same time in Morse signals on the tapes of the two corresponding receivers at Poole.

"In this first demonstration each receiver was connected to its own independent aerial wire hung from the same mast. But greater wonders followed. Mr. Marconi placed the receivers at Poole one on the top of the other, and connected them both to one and the same wire, about 40 ft. in length, attached to a mast. I then asked to have two messages sent at the same moment by the operators at St. Catherine's, one in English and the other in French. Without failure each receiver at Poole rolled out its paper tape, the message in English perfect on one and that in French on the other. When it is realised that these visible dots and dashes are the results of trains of intermingled electric waves rushing with the speed of light across the intervening 30 miles, caught on one and the same short aerial wire, and disentangled and sorted out automatically by the two machines into intelligible messages in different languages, the wonder of it all cannot but strike the mind."

The method of using two or more aerials for the purpose of receiving a corresponding number of messages at the same time is well known, and is utilised where necessary by the Marconi Co., both on land and at sea.

The Marconi International Marine Communication Co., Ltd.
W. W. BRADFIELD, *Joint General Manager.*

London, *January 30th*, 1924.

Two-way Pendant Switch Flexibles.

In your last week's issue there is a letter from "Safety First" complaining of his inability to obtain machine-twisted three-core flexible. We have been making this three-core flexible for nearly 30 years, and we can always supply it, either from stock or within two or three days. We cannot understand "Safety First" having any difficulty in obtaining it.

We would, whilst on this subject, like to impress upon all users of flexible cords, particularly for pear suspension switches, that the use of a cheap, thin insulated cord is a dangerous practice, and a possible cause of fire. For pear switches, switch lampholders, and the like we recommend that a cord of not less than 23/36 capacity be used, with a substantial pure rubber or vulcanised rubber insulation, or, preferably, with an asbestos separator between each conductor, such as our "Feroflex."

Ward & Goldstone, Ltd.

Manchester, *January 31st*, 1924.

Electric Passenger Lifts.

The interesting paper on "Electric Passenger Lifts," reported in your January 24th issue, gives the impression, held also in America, that English lift builders have not made electric lifts for a speed of 400 ft. per minute.

The writer of the paper must surely be aware that in various blocks of office buildings in Kingsway, and also in Marconi House, Strand, lifts are running at speeds above 400 ft. per minute, and were made in this country.

T. W. Burdes.

Ipswich, *January 31st*, 1924.

The Position of the Colliery Engineer.

We gladly take up your challenge and, in stating our case, are content to leave the issue to the fair and critical judgment of those of your readers who have knowledge of mining practice as well as of electrical engineering. The most controversial and complex phase of engineering discussion has always been and still is "status." You have opened up the quintessence of complexity when you broach the "status" of the combined engineer-miner and, with all due respect, your expressed opinions reflect the tangle of the maze into which you have entered. There is really no need to waste further time and create greater confusion in the pursuit of "ocean liners" and "express locomotives"—they have nothing to do with the case.

Reduced to a few plain words your contentions are:—

(*a*) That the colliery mechanical and electrical engineer should be "certificated" by the Government.

(*b*) That the Association of Mining Electrical Engineers "had as its main object the purpose of settling the question of responsibility, and raising the status of the engineers on the lines we have suggested," *i.e.*, as in the preceding paragraph (*a*).

Let us then analyse your case in favour of your first contention (*a*). In your own words: "The Government of this country institute all of them (certificates) with one object, and that is what we are now striving for—the prevention of accidents and loss of life, as well as damage to property." You perceive and agree that the Government instituted these systems for the reason that they considered the safety of lives and property depended upon doing so.

The Government will accordingly institute certification of colliery electrical engineers when they consider that by doing so life and property now lost would be saved.

Your correspondents have indicated how remarkably safe has become the use of electricity in mines—and shown, moreover, that the electrical risks underground are still declining; the reports of the Government indicate the extremely close attention which they pay to this phase of mining work, and the Government so far have not seen fit to "certificate" colliery electricians.

Passing now to your second contention, (*b*): You have defined what you believe to have been the main object of the Association of Mining Electrical Engineers—and you say that object was "stifled" because colliery managers, agents, and representatives were admitted to membership of the Association. Neither statement is true.

The Memorandum of Association of the A.M.E.E. states:—

"The objects for which the Association is established are:—

(*a*) "To consider means for minimising the risks attending the application of electricity to the industry of mining, and to promote the adoption of approved methods and devices tending to increase safety."

(*b*) "To promote the general advancement of electrical science in its application to the industry of mining; to facilitate the exchange of information and ideas on this subject amongst the members of the Association and otherwise; and, generally, to extend the experience, increase the efficiency, and elevate the status of those engaged in such applications."

The admission of colliery managers, owners, agents, manufacturers, &c., to membership was therefore desirable and necessary, so that the colliery electrician members and they should mutually benefit by conference and the objects of the Association be thereby attained. In support of this it is valuable to note that the "descriptions" of the ten original subscribers as appended to and published with the Memorandum of the Association are, respectively: Mining Engineer, Engineer, Consulting Engineer, Mining Engineer, Mining Electrical Engineer, Mining Engineer, Mining Electrical Engineer, Mining Electrical Engineer, Electrical Engineer, Consulting Engineer and Electrician.

The Association never had the intention of working for the Government certification of the colliery electrician—and, of course, never having held it, has never dropped it.

You then, after this false premise, follow by asking the Association point blank: "Do you propose, as a body, to support it now?"

It is quite proper for the ELECTRICAL REVIEW, or any other interested journal, to support or break any cause or system according to its judgment and its knowledge of its readers' sentiments; it is quite different when you invite another party to exceed its duty and misapply its authority.

As said, the Government will institute certification of colliery engineers when they, after due deference to the mining industry as a whole, decree that it is necessary.

The A.M.E.E. is truly and solely a technical society; its objects are explicit and strictly confined by its Articles of Association.

You were so good as to write: "We agree with the President that a great improvement has taken place during the past few years and no doubt much of it has been due to the Association." Also previously in acknowledgment of correspondents' protests you claimed that you "had no intention either of misleading our readers or of depreciating the undoubtedly good work done by the A.M.E.E.," yet you disparagingly comment that there "are only 2,000 members whilst there are some 3,000 collieries alone."

That was in your last article (January 16th) put together after full consideration and in accordance with the promise you gave in yours of January 4th "to deal further with the subject." Let us return to your first editorial, that of December 14th last, and once again quote your own words: "What a vast amount of complicated and expensive plant is in use at the 1,557 mines where electricity is installed, out of a total of 2,911 mines at work." Only 2,000 members of the A.M.E.E. and 1,557 mines using electricity reads rather better than the way you made your comparison.

To keep the issue clear we must again repeat that the Government has not yet seen the necessity of certificating colliery engineers, because presumably they have not yet concluded that to do so would increase safety in mines. You make the sweeping assertion: "We also sincerely believe we are voicing the desire (for Government certificates) of every colliery mechanical and electrical engineer in this country." Every engineer, mark you!

The inference is then, according to your arguments, that the colliery electrician feels that his work in the mines is so badly done that lives and property are thereby endangered; that the reason he would advance for this is that he has to work under the mines' manager; that if he only had the status and responsibility conferred by a Mines Department certificate his work would be ever so much safer. If that is not to be inferred from the very deliberate and lengthy explanations you give of the relative responsibilities and qualifications of the various mines' officials, then what is the inference? Perhaps it is, after all, as a correspondent ventured to suggest, and as you were at pains to controvert, a sort of trade union feeling. Your readers will be able to judge for themselves.

One more short quotation from the Articles of the A.M.E.E.: "Provided that the Association shall not support with its funds, or endeavour to impose upon or procure to be observed by its members or others of any regulation or restriction which if an object of the Association would make it a trade union."

The success of the A.M.E.E.—and it is very considerable—has been achieved by a close observance of its Articles. The fact that every technical man who is experienced in, and has industrial or scientific interest in the use of electricity in mines is eligible for membership has brought together exactly those men who can and do actively exercise the most powerful influence in promoting the safety of mining electrical plant and of increasing the prestige and reputation of the colliery electrical engineer.

W. T. Anderson,
On behalf of the Association of Mining Electrical Engineers.

Manchester, *January 28th*, 1924.

[We refer to this matter elsewhere in this issue.—EDS. ELEC. REV.]

Squirrel-cage Motors of over 5 h.p.

The writer is particularly interested in the correspondence published on the above subject, and would like to suggest that polyphase squirrel-cage motors up to 100 h.p. should be thrown directly on the line, thus dispensing with a starter. In the majority of cases it is better to start a s.c.r. motor by this method, as there is less heating of the motor and less disturbance of the line than with any other method of starting which is in common use.

This method of starting is not suitable in every case, *e.g.*, that of a motor driving a machine, such as a shearing machine, having very great inertia. In any case, a s.c.r. motor should not be fitted to such a machine, and such exceptions are few.

The trouble appears to be that the outlook of some station engineers has not broadened proportionally with the increase of generating plant at their stations. With the modern power station equipment the effect of throwing a 100-h.p. s.c.r. motor directly on the line, even though it be started under full-load conditions, should be negligible.

E. W. Walker.

Manchester, *January 31st*, 1924.

"Motor Sales Engineer" and others have very little use for the clause limiting the size of squirrel-cage motors, which a large number of supply authorities enforce.

I should like to point out that the clause is in no way to be compared with the red flag of the early motoring days, but is brought in only after very careful consideration.

It is quite true that power stations and feeders are rapidly increasing in size, but it should be borne in mind that for the usual corporation supply authority the ratio of power load (largely inductive) to total load is ever increasing, with a consequent lowering of the power factor. This fact may not trouble the man who has motors to sell, but is a very important item indeed for central-station engineers.

Numerically the lighting consumers form a large proportion of the average corporation network, and the mains department will not look favourably on a motor which causes a kick (sometimes very objectionable) on all the lights in the neighbourhood each time it is started up or switched off. Obviously the 200-h.p. motor mentioned by "Salesman" would not come directly off the lighting mains, but would

probably be across the outers or between phases, depending on the system, so this can hardly come into the argument.

Power companies are in a different category. They are out to sell power, and all their charges and technical calculations are worked out with an assumed power factor of about 0.7. Large motors and other devices are not being continually switched on and off, and so cause less trouble and are more profitable than the small a.c. motor on the corporation mains.

By inserting the clause which limits the size of motors, the corporation engineer is in no way retarding development, as has been suggested, but is, in point of fact, looking ahead.

R. Howe.

London, *February 2nd*, 1924.

Russian Electrical Notes.

The Petrograd "Weak Current" Trust.

The Petrograd Electrical "Weak Current" Trust factories are reported to be doing well, with many orders in hand, including a contract to equip Ekaterinburg with a telephone installation for 10,000 subscribers. They have orders also for 85 aeroplane radio stations, &c. The works are being extended. The construction of a.c. meters is being actively developed. Recently a loud-speaking telephone was tested, with satisfactory results. There is plenty of fuel, and raw material is coming forward normally.

Electricity in the Ukraine.

The Ukraine Electrification Committee is urging the immediate erection of a fresh regional power station for Kieff. It may take the form of a hydro-electric station on the river Desenka. Electricity is becoming steadily more popular in the Government of Iver, where the peasant industries district of Kushalinsky has recently inaugurated a co-operative lighting supply. A co-operative body in Kalyasina has hired the town power station, which will be repaired and enlarged for the supply of light and power. A note from Ryazan says that the Town Council of Ranenburg proposes to electrify the town and suburbs.

New Regional Station.

On the banks of the Volga, near the town of Balachany, the Nizhegorod regional electrical station, which will play a great part in the development of Nizhegorod industry, is being built. The site was chosen on account of the peat deposits in the district of Balachany.

The initial capacity of the station will be 20,000 kW; the equipment, in the first place, will consist of two three-phase turbo-alternators generating at a pressure of 6,600 V. The boiler battery will consist of ten vertical water-tube boilers with a heating surface of 760 square metres each. The necessary cooling water will be conveyed through two underground pipes from a specially-constructed pond fed from the river running near the station. A specially-constructed railway will bring the peat to the station, where it will be fed to the furnaces mechanically.

All the necessary equipment has been ordered abroad and should be on the site in the course of a year. Building work has already begun, and it is expected that the station will be started up early in 1925.

Electrifying Russia's Salt Works.

A message from Bachmut says that the first large transmission line in the salt-bearing district of the Don basin was formally inaugurated on the seventh anniversary of the Revolution. This will make it possible to electrify the largest salt industries in the basin.

Turbo-Generator from Abroad.

The Ural-Platina concern is asking for permission to order a turbo-generator from abroad, to be installed in April next; if ordered in Russia it would probably not be ready for a year.

Russian Lamps Satisfactory.

Six months' trial of Russian electric lamps in the central district have just been completed at the instance of the Glavelektro and three reputable scientific experimental institutes in the Republic. The test took place without any interference by the Trust. The lamps were taken from the general bulk and the tests were intended to show whether the Russian lamp was in a position to compete with Western European lamps, both in the inland and foreign markets, particularly in the East, Persia, Turkey, &c., where the Russian lamp has already begun to appear. All tests, generally, pointed to the efficiency of the present Russian lamp, which is particularly satisfactory to the users, being economical in point of current consumption, and excelling the foreign lamps in respect of duration, the filaments being mechanically strong, the strength of the light being quite constant, and the sensitiveness to variations in pressure being slight.

Published Specifications.

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL and STEPHENS, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

19,040. "Telegraph systems." Western Union Telegraph Co. April 20th, 1922. (196,879.)

19,496. "Electron discharge devices and electron-emitting cathodes therefor." British Thomson-Houston Co., Ltd. August 11th, 1921. (184,466.)

24,772. "Electric switches for use in the magnetisation of permanent magnets." Stentophone Motor Accessories (1921), Ltd., and A. H. Taloggan. September 13th, 1922. (209,459.)

27,134. "Manufacture of knobs, terminals, and the like, and tools to be used in such manufacture." A. Round and R. W. Seaby. October 7th, 1922. (Cognate application 16,642/23.) (209,468.)

27,300. "Electric switches." C. D. S Cranko. October 9th, 1922. (209,476.)

27,544. "Electric motor control systems." L. B. Hewitt and Metropolitan Electric Tramways, Ltd. October 11th, 1922. (209,492.)

27,670. "Wireless apparatus." E. Hoyle. October 12th, 1922. (209,500.)

27,961. "Vacuum tubes." E. Y. Robinson. October 16th, 1922. (209,515.)

29,611. "Thermally-actuated device for controlling electric circuits." P. W. Baker. October 30th, 1922. (209,522.)

29,680. "Vacuum tubes." E. Y. Robinson. October 31st, 1922. (209,524.)

29,881. "Electric switchgear." H. Trencham, British Thomson-Houston Co., Ltd., and H. C. Heath. November 1st, 1922. (209,527.)

29,954. "Oscillating electric fans." A. H. Railing and A. E. Angle. November 2nd, 1922. (209,530.)

29,988. "Contact spring sets, such as are used in telephone systems." Siemens Bros. & Co., Ltd., and W. E. Goodwin. November 2nd, 1922. (209,531.)

30,522. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., and G. H. Bryant. November 8th, 1922. (209,537.)

31,114. "Electric locomotives and other electrically-propelled vehicles." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 16th, 1922. (209,545.)

31,675. "Wind-driven electrical generators." Telford, Grier & Mackie, Ltd., and W. Henderson. November 20th, 1922. (209,552.)

32,208. "Transmitting and receiving graphic records by wireless signals." Etablissements E. Belin and E. Belin. November 24th, 1922. (209,563.)

33,244. "Telegraph synchronising system." D. Murray. December 6th, 1922. (209,573.)

33,322. "Wireless apparatus." B. H. N. H. Hamilton. December 6th, 1922. (209,575.)

33,350. "Spark-discharge devices." R. C. Galletti. December 6th, 1922. (209,576.)

33,721. "Electric couplings." W. A. Eastaway. December 11th, 1922. (209,580.)

35,034. "Electric current amplifiers." British Thomson-Houston Co., Ltd. December 28th, 1921. (191,038.)

35,143. "Electrical impulse clocks, and cases therefor." I. H. Parson and A. E. J. Ball. December 27th, 1922. (209,590.)

35,415. "Safety devices for winding or hoisting apparatus." C. E. Rayburn and Metropolitan-Vickers Electrical Co., Ltd. December 29th, 1922. (209,595.)

1923.

1,884. "Electrically-driven submersible pump equipments operated by direct current." A. D. Constable and F. P. Fletcher. January 22nd, 1923. (209,606.)

2,184. "Electrical static transformers and analogous apparatus." E. F. Tasker. January 24th, 1923. (209,607.)

4,597. "Box or carton for holding electric lamps." R. Hunt. February 16th, 1923. (209,618.)

5,577. "Direct-indicating high-vacuum meters." Akt. Ges Browa, Boveri et Cie. March 4th, 1922. (194,284.)

5,740. "Electrotherapeutic apparatus." E. K. Müller. March 9th, 1923. (194,689.)

6,761. "Electric time switch." Landis & Gyr Akt. Ges. August 17th, 1922. (202,609.)

8,463. "Rectifiers for alternating electric current." T. P. Gath. March 24th, 1923. (209,645.)

8,862. "Street boxes for fire alarms and like systems." Gamewell Fire Alarm Telegraph Co. December 27th, 1922. (209,015.)

9,664. "Protective systems for electric circuits." Metropolitan-Vickers Electrical Co., Ltd. April 7th, 1922. (195,984.)

10,095. "Construction of electric switch." G. Marr. April 13th, 1923. (209,653.)

17,570. "High-frequency electro-magnetic apparatus having metallic magnetic circuits." M. Latour. July 6th, 1923. (209,683.)

18,749. "Arrangements for improving the parallel-working of mercury vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. July 20th, 1922. (201,179.)

21,256. "Packing gland for an accumulator terminal." Soc. des Accumulateurs Fixés et de Traction. September 6th, 1922. (203,671.)

Electricity Supply in London.—The agenda for the meeting of the London County Council on February 5th embodied a report of the Special Committee on London Electricity Supply upon forthcoming legislation. With regard to the Bill deposited by the County of London Electric Supply Co., the Committee states that it appears to be the aim of the promoters to supply from their Barking station a number of undertakings which are now purchasable by the Council; this would inevitably lead to complications. Other points of objection are the absence of a protection clause for local authorities in respect of the areas over which the company seeks distribution powers, the high prices which the company seeks to charge, and the infrequent opportunities allowed for revision. The main objection, however, is that the Bill would aggravate existing difficulties in the matter of the reorganisation of London's electricity supply. The same criticism is also applied to the Bill which is being promoted by the North Metropolitan Electric Power Supply Co., and the Council is recommended to make strong representations to the Ministry of Transport against both measures.